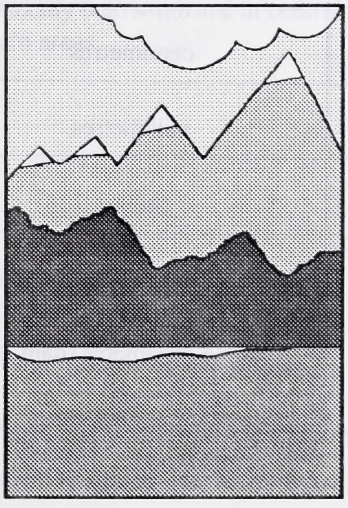
AL. 1. 893
c 2

Water Supply Outlook for Alberta

CANADIANA
FEB 24 1993

February 1993



Alberta
ENVIRONMENTAL PROTECTION

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly; from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

February 1993

Overview

Below-average water supply is expected from rivers in southern and central Alberta for the summer of 1993.

The mountain snowpack in the headwaters of the Bow, Red Deer, North Saskatchewan, Athabasca and Peace River basins is much below-average. In the headwaters of the Oldman River basin, conditions are below-average.

As of February 1, streamflow volumes for the summer of 1993 are expected to be much-below-average in the Bow, North Saskatchewan and Athabasca River basins. Conditions are expected to be below-average for the Oldman, Milk and Red Deer River basins.

A more detailed forecast of streamflow volumes for major streams in southern Alberta will be issued in early March. Precipitation between now and the end of September will greatly affect the summer water supply.

Snowmelt runoff for the spring of 1993 is expected to range from below-normal to much-below-normal in the plains areas of Alberta. If precipitation during February and March is above-average, this outlook could change.

At present, groundwater levels are generally below-normal in central, eastern and northern areas of the province. Levels are normal in southern areas.

1993 Spring Snowmelt Runoff Outlook

At the present time, snowmelt runoff for the coming spring is expected to range from below-normal to much-below-normal in the plains areas (Figure 1). These runoff conditions are the result of low soil moisture and snowpack conditions.

In the fall of 1992, extremely dry soil moisture conditions prevailed in most of the eastern plains areas. Soil conditions were somewhat better along the foothills.

Winter precipitation has been below-average in the northern half of the province, and average for most of the southern and central Alberta plains. The plains area snow cover ranges from near-average to below-average as a result. If precipitation during February and March is above-average, the runoff outlook could change.

Water Supply Volume Forecasts for the Summer of 1993

Natural streamflow volumes for May to September 1993 are expected to be much-below-average for the Bow, North Saskatchewan and Athabasca River basins. Below-average streamflow is forecast for the Oldman, Milk and Red Deer River basins. The volume forecasts are presented in the following table.

Water Supply Volume Forecasts as of February 1, 1993

Location	May to September 1993 Natural Streamflow Volume Forecasts as Compared to Average
Milk River at Milk River	below-average
Oldman River at Lethbridge	below-average
Bow River at Calgary	much-below-average
Red Deer River at Red Deer	below-average
North Saskatchewan River at Edmonton	much-below-average

Precipitation between now and the end of September will greatly affect the summer water supply. The streamflow volume forecasts will be updated monthly until mid-summer. Upcoming reports will present the volume forecasts as a percentage of average.

Groundwater Conditions

At present, groundwater levels for both shallow (less than 20 metres) and deep (greater than 20 metres) wells were generally below-normal in central, eastern and northern areas of the province. Levels were normal in southern areas.

Water levels in some shallow wells have fallen due to very little recharge reaching these aquifers during the fall and winter months.

The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of February 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	normal
Cypress Hills	below-normal	above-normal
Lethbridge	normal	normal
Calgary	below-normal	below-normal
Coronation-Brooks	below-normal	below-normal
Red Deer	normal	normal
Edson	normal	normal
Edmonton-Lloydminister	normal	below-normal
Whitecourt-Athabasca	below-normal	below-normal
Cold Lake	below-normal	below-normal
Grande Prairie-Peace River	normal	normal

Mountain Snowpack

At the end of January, the mountain snowpack in the headwaters of the Bow, Red Deer, North Saskatchewan and Athabasca River basins was much-below-average. Conditions ranged from below-average to average in the headwaters of the Oldman River basin.

Present mountain snowpack conditions are shown in the following table and in Figure 2.

Mountain Snowpack Conditions as of February 1, 1993

Area	Snowpack Condition (percentage of average)
Waterton/St. Mary River Headwaters	80 to 95
Oldman River Headwaters	60 to 80
Highwood/Kananaskis River headwaters	50 to 60
Bow River Headwaters	30 to 60
Red Deer River Headwaters	50 to 100
North Saskatchewan River Headwaters	30 to 50
Athabasca River Headwaters	30 to 50

In late January, much-below-average snowpacks were measured for most of the mountain areas along the continental divide northwest of the Crowsnest Pass up to the Peace River headwaters. Several new record-low snowpack measurements were made in the Bow, North Saskatchewan and Athabasca River basin headwaters.

Fall 1992 Weather Conditions

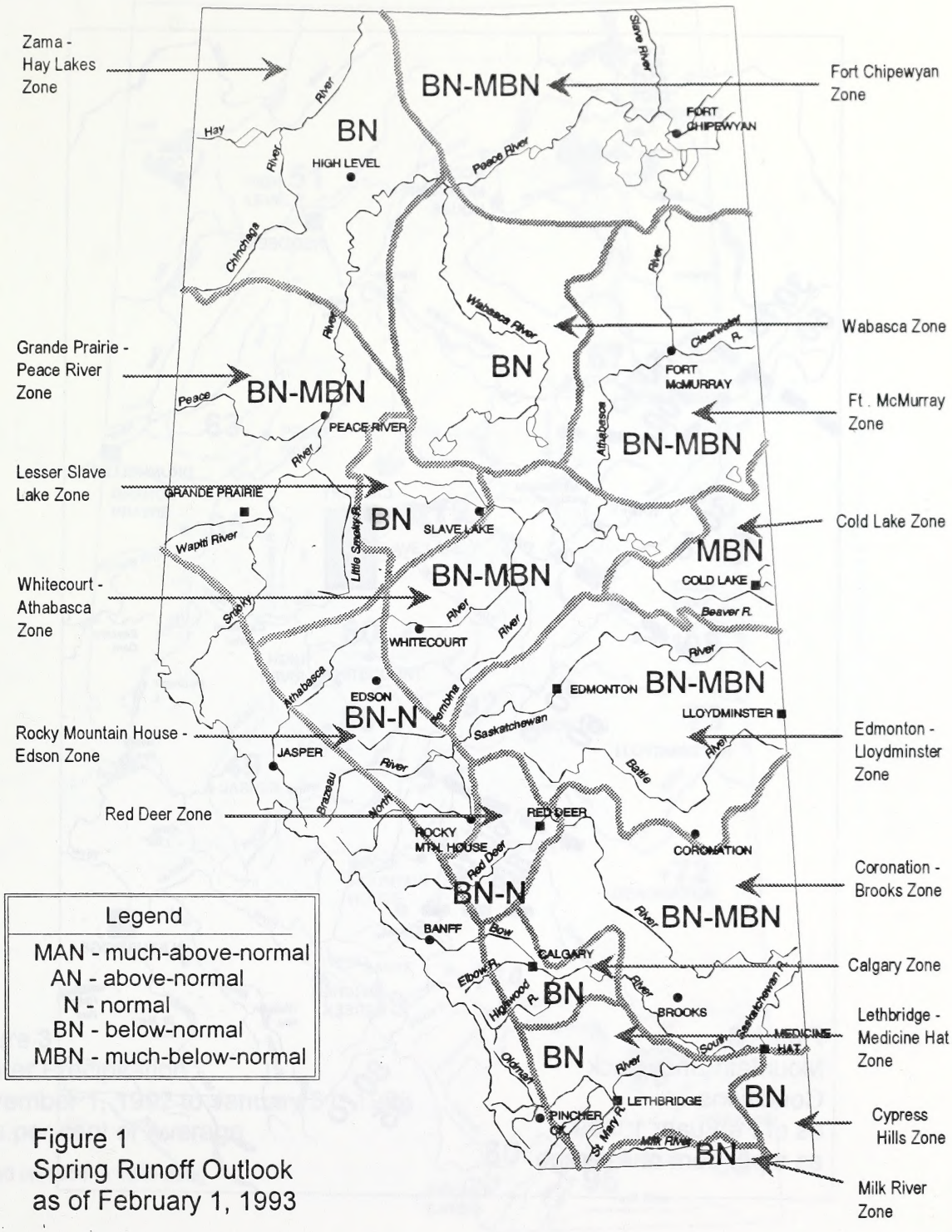
Fall precipitation (September 1 to October 31, 1992) was average to above-average for most areas of the province (Figures 3 and 4). Soil moisture levels on the plains ranged from adequate to extremely dry as a result of the lack of summer rainfall in 1992.

There were significant snowfalls in September, particularly in northern regions. In October, heavy snowfalls occurred in southwestern Alberta. Most of the central and southern Alberta plains had a light snow cover by Halloween.

Winter 1992/1993 Weather Conditions

Winter precipitation (November 1, 1992, to January 31, 1993) was below-average in the mountain parks and the northern half of the province. It was average for most of the southern and central Alberta plains (Figures 5 and 6).

January precipitation was well-below average for most of the province. Nearly all areas had less than 50 percent of average precipitation for the month. At the beginning of 1993, temperatures were much below-normal throughout most of Alberta. Temperatures returned to normal by mid-month. Chinook winds and above-normal temperatures at the end of January depleted the plains area snowpack considerably.



Legend
MAN - much-above-normal
AN - above-normal
N - normal
BN - below-normal
MBN - much-below-normal

Figure 1
Spring Runoff Outlook
as of February 1, 1993

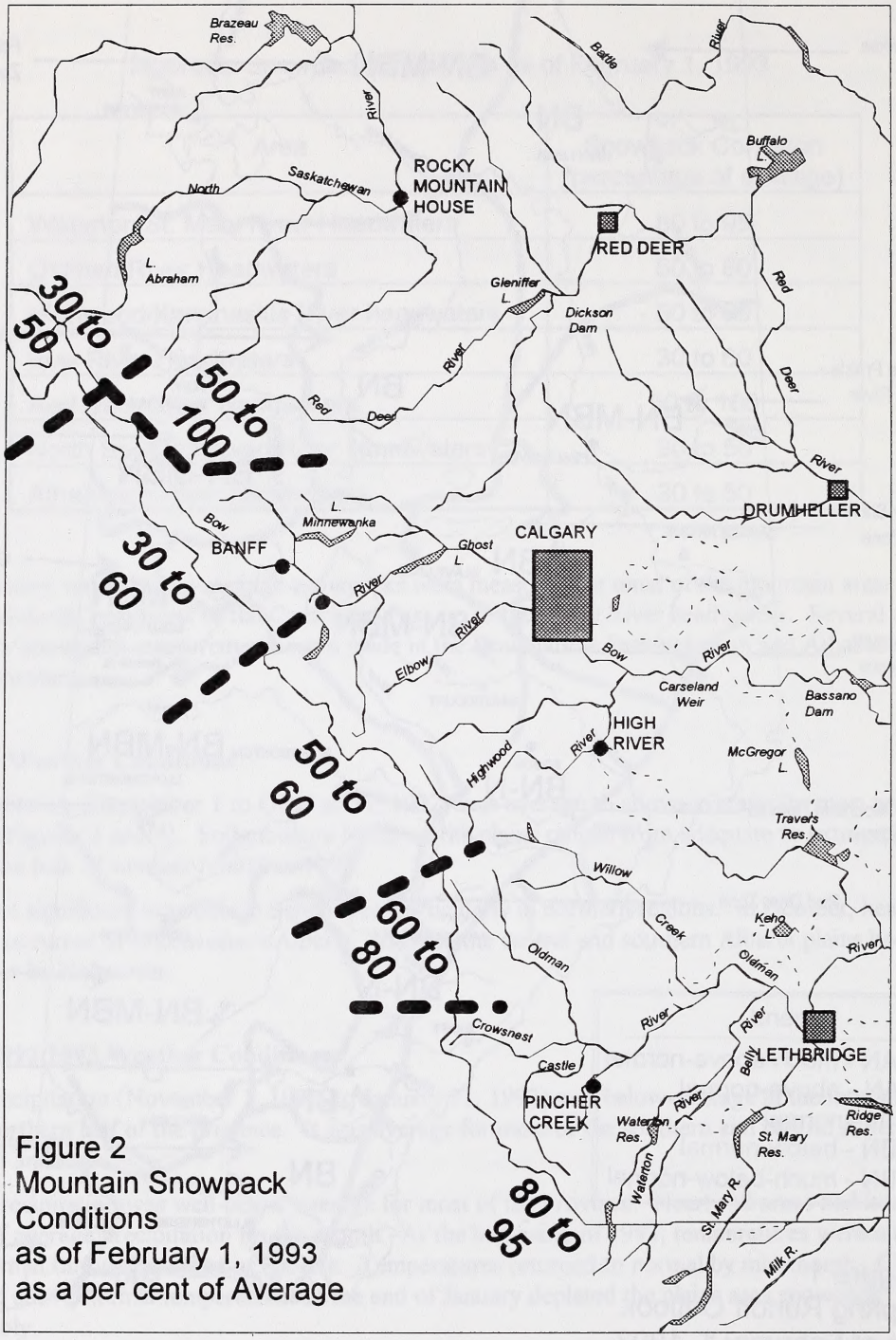


Figure 2
Mountain Snowpack Conditions
as of February 1, 1993
as a per cent of Average

Alberta
ENVIRONMENTAL PROTECTION

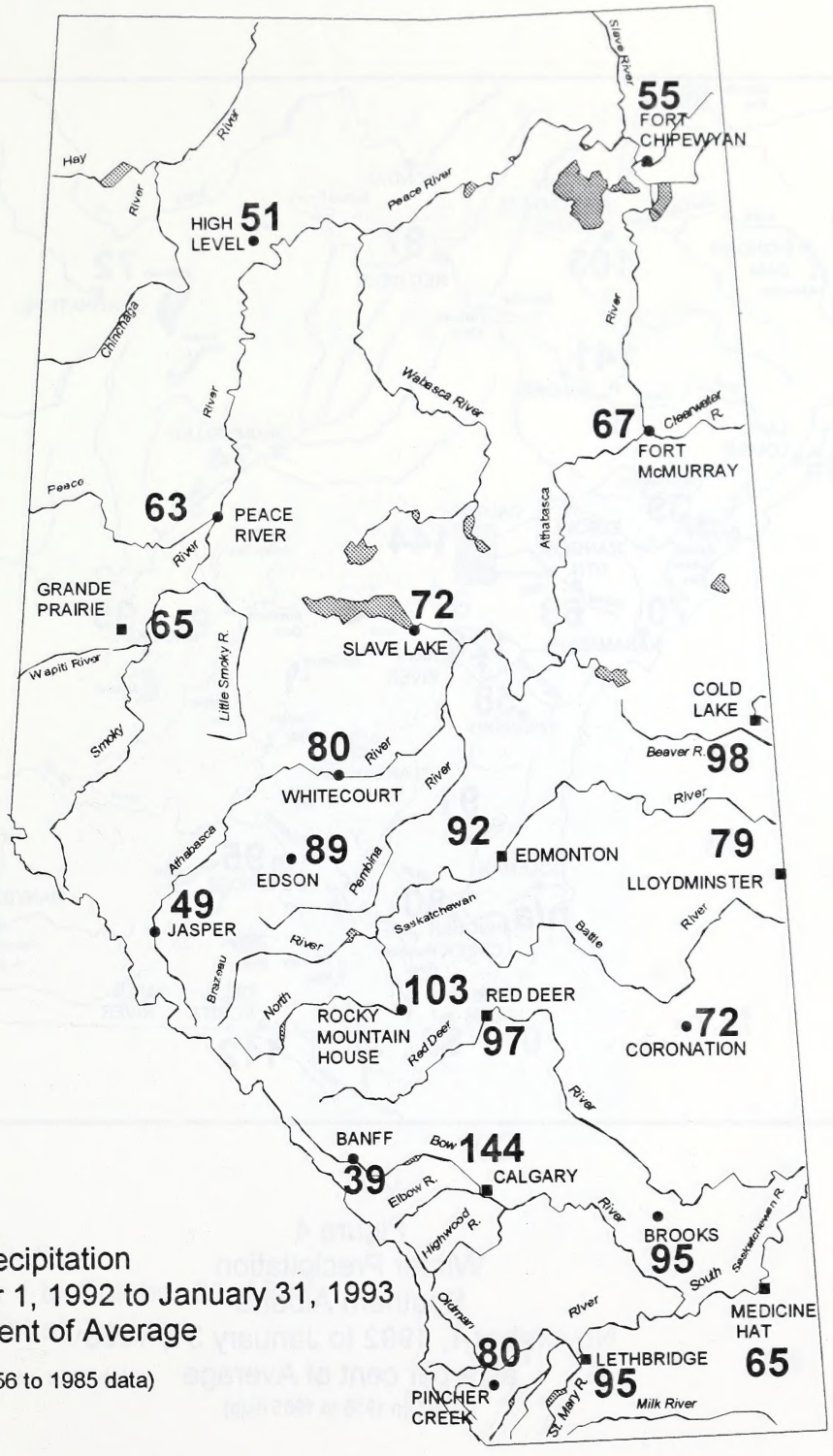


Figure 3
Winter Precipitation
November 1, 1992 to January 31, 1993
as a per cent of Average

(based on 1956 to 1985 data)

Alberta
ENVIRONMENTAL PROTECTION

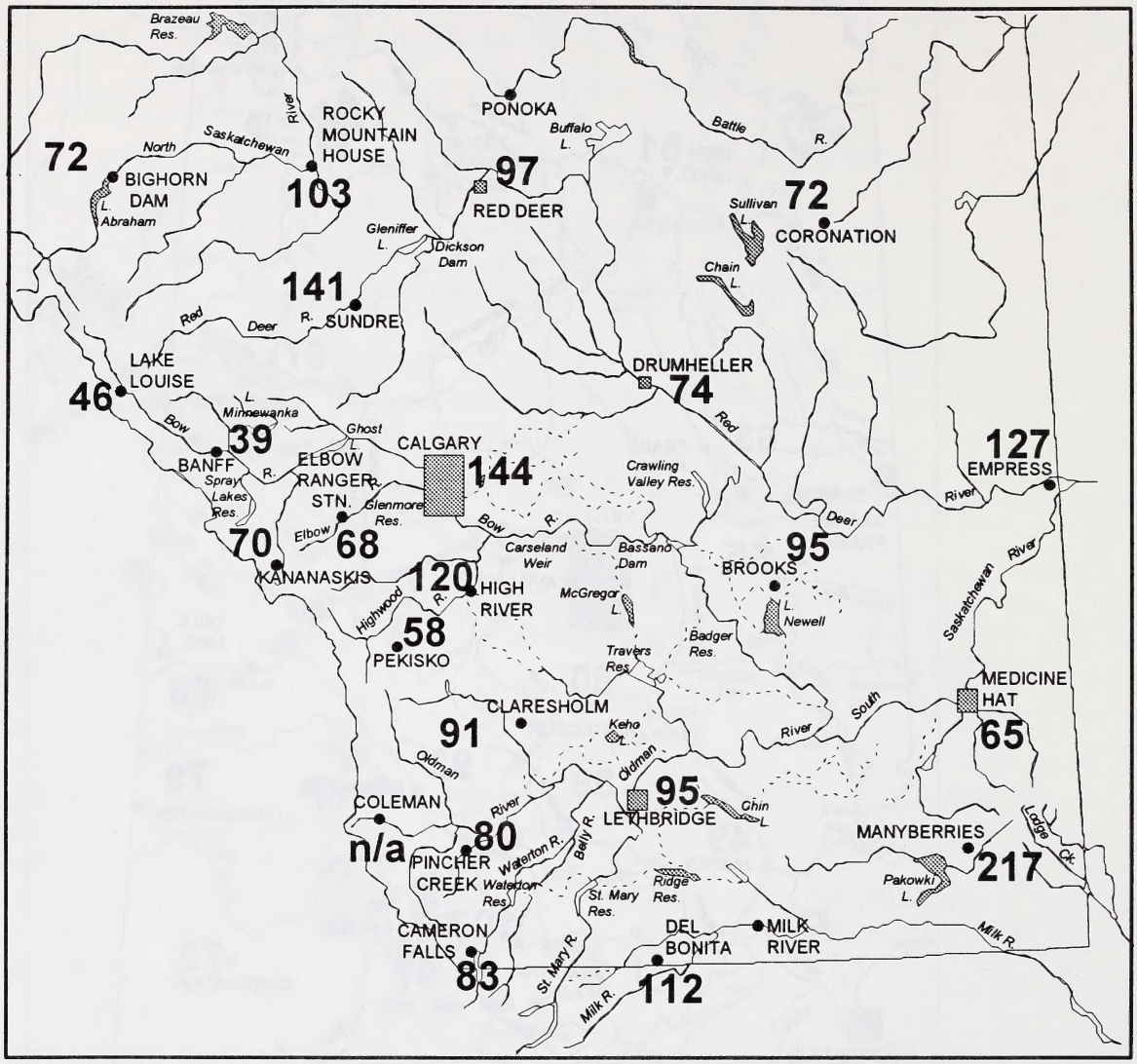


Figure 4
Winter Precipitation
Southern Alberta
November 1, 1992 to January 31, 1993
as a per cent of Average
(based on 1956 to 1985 data)

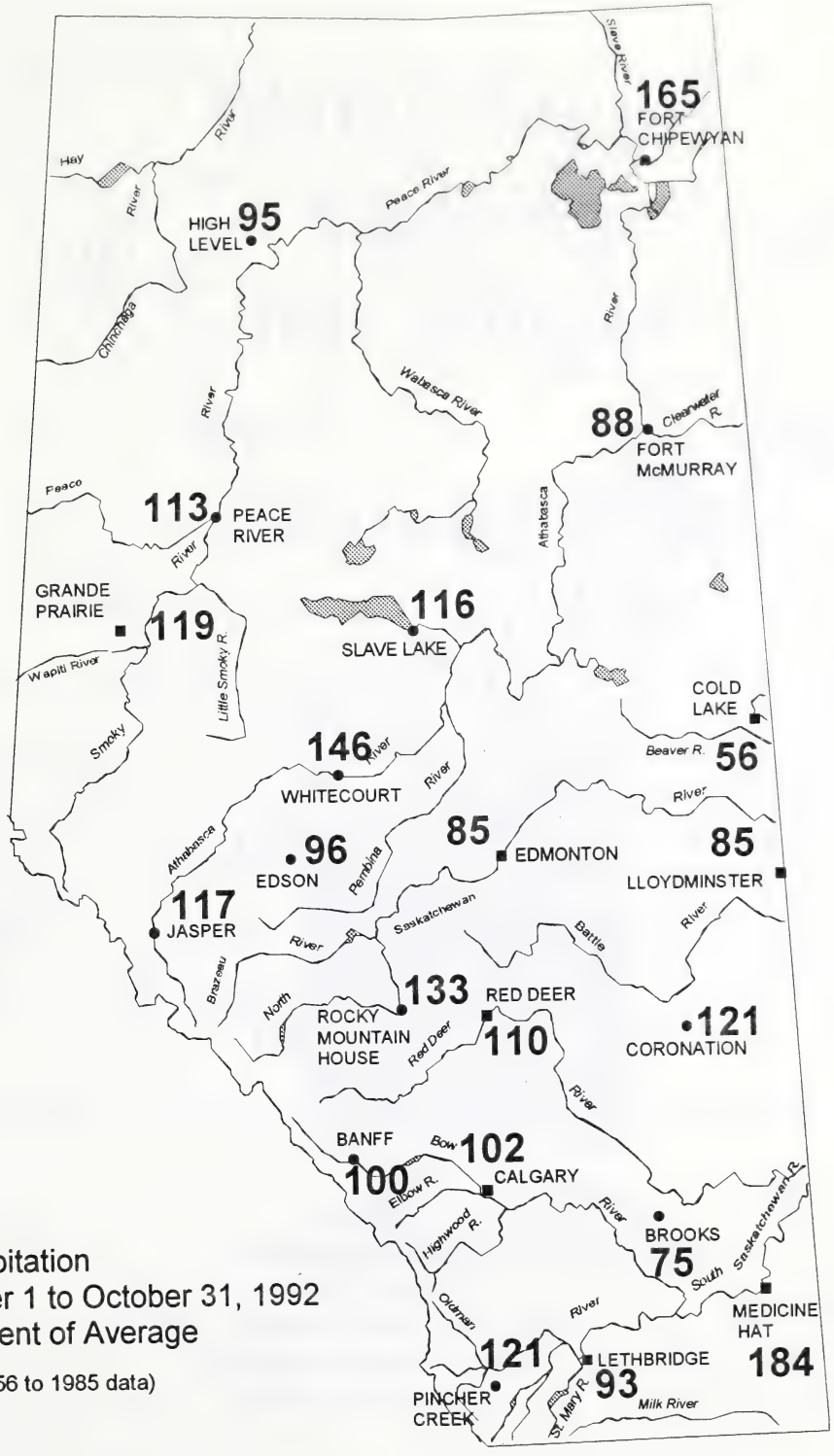


Figure 5
Fall Precipitation
September 1 to October 31, 1992
as a per cent of Average

(based on 1956 to 1985 data)

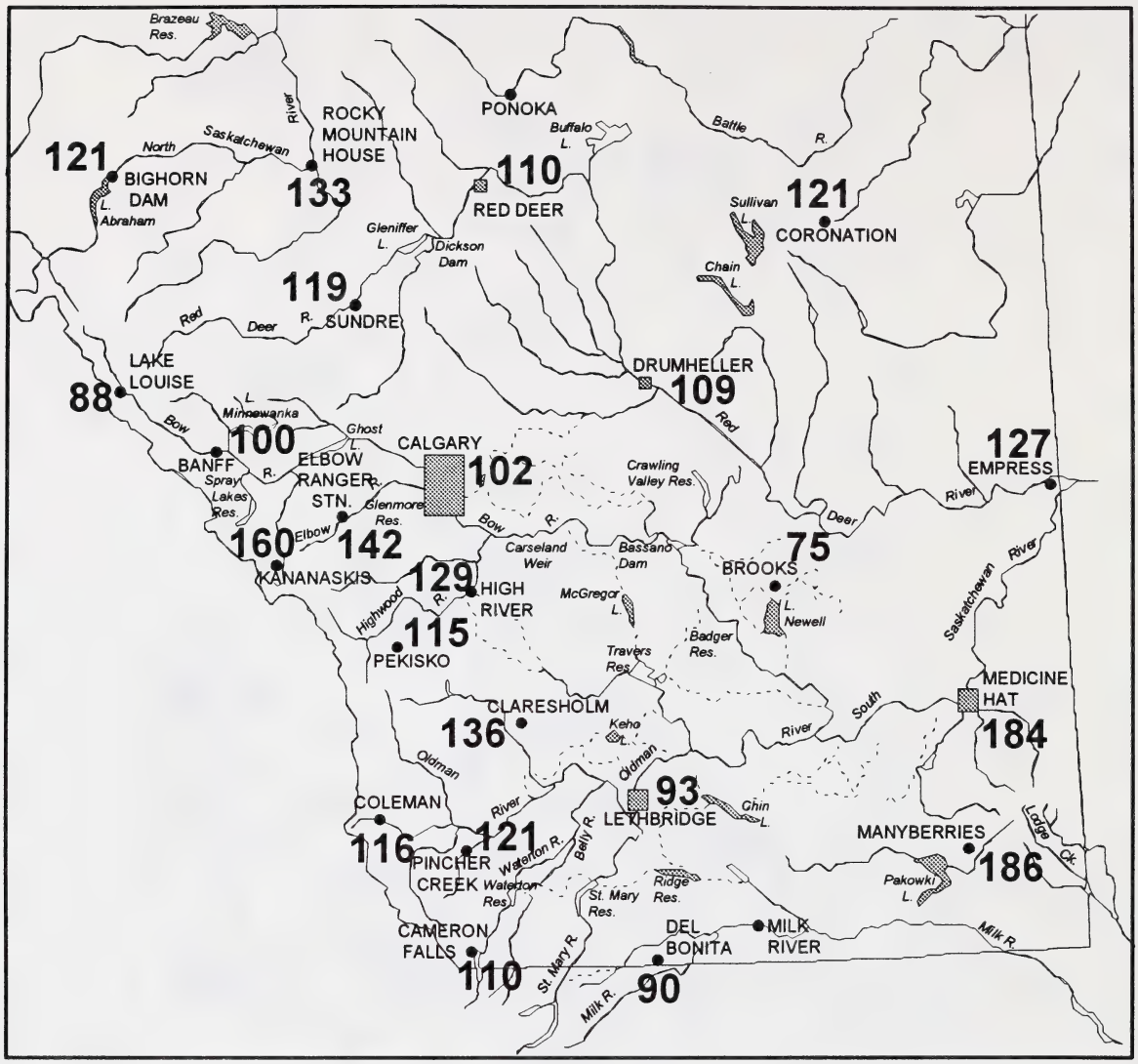
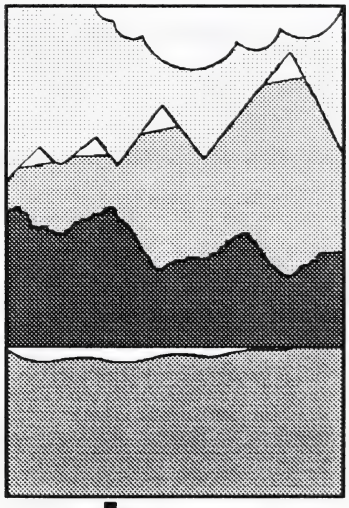


Figure 6
Fall Precipitation
Southern Alberta
September 1 to October 31, 1992
as a per cent of Average
(based on 1956 to 1985 data)

GL. 1.873
c2

Water Supply Outlook for Alberta

March 1993



Alberta
ENVIRONMENTAL PROTECTION

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly, from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

March 1993

Overview

Much-below-average water supply is expected from the Bow, Red Deer, North Saskatchewan and Athabasca Rivers for the summer of 1993. Water Supply conditions are expected to be below-average for the Oldman and Milk Rivers.

The mountain snowpack in the headwaters of the Bow, Red Deer, North Saskatchewan, Athabasca and Smoky River basins is much below-average. In the headwaters of the Oldman River basin, the mountain snowpack conditions are below-average.

Spring snowmelt runoff is forecast as much-below-normal to below-normal in the eastern and southern plains areas and northern regions of Alberta. Normal runoff is expected from rivers with headwaters in a narrow band along the foothills extending from south of Grande Prairie to the Montana border. The low runoff conditions on most of the plains areas are the result of low soil moisture and low snowpack conditions.

At present, groundwater levels are generally below-normal in central, eastern and northern areas of the province. Levels are normal in southern areas.

An updated forecast of streamflow volumes for major streams in southern Alberta will be issued in early April. Precipitation between now and the end of September will greatly affect the summer water supply.

1993 Spring Snowmelt Runoff Outlook

For March 1st, spring snowmelt runoff is forecast as much-below-normal to below-normal in the eastern and southern plains areas and northern regions of Alberta (Figure 1). Normal runoff is expected from rivers with headwaters in a narrow band along the foothills extending from south of Grande Prairie to the Montana border. The low runoff conditions on most of the plains areas are the result of low soil moisture and low snowpack conditions.

At the end of February, well above-average temperatures started spring runoff on most of the southern Alberta plains. Runoff was also starting to get underway in central Alberta. Along the foothills, from the Montana border north to Grande Prairie, streams rose moderately in response to snowmelt at low elevations.

Winter precipitation has been well below-average in the northern half of the province, and average for most of the southern and central Alberta plains. The plains area snow cover is generally below-average as a result. There is a narrow band extending from Grande Prairie through Rocky Mountain House Claresholm where plains areas snowpack is near average.

Water Supply Volume Forecasts for the Summer of 1993

Natural streamflow volumes for May to September 1993 are forecast as much-below-average for the Bow, Red Deer and North Saskatchewan and Athabasca River basins. Near record low streamflow volumes are forecast for the Bow River basin. Below-average streamflow is forecast for the Oldman and Milk River basins. The volume forecasts are presented in the following table. The 1992 actual streamflow volumes are given for comparison.

Water Supply Volume Forecasts as of March 1, 1993

Location	May to September 1993 Natural Streamflow Volume Forecasts as a per cent of average	Actual Natural Streamflow Volumes May-September 1992 as a per cent of average
Milk River at Milk River*	80	21
Oldman River at Lethbridge	82	52
Bow River at Calgary	75	80
Red Deer River at Red Deer	75	96
North Saskatchewan River at Edmonton	74	73

* The value for Milk River is for the period April 1 to September 30.

Precipitation between now and the end of September will greatly affect the summer water supply. The streamflow volume forecasts will be updated monthly until mid-summer. More detailed streamflow forecasts are presented in Tables 1,2,4,6 and 8.

Water Storage Situation

Water storage in most of the major hydroelectric reservoirs is normal, which is similar to this time last year (Tables 3,5,7 and 9). Upper Kananaskis Lake is above-normal and Spray Lake is below-normal.

Water storage in most of the major irrigation is normal, which is also similar to this time last year. Ridge Reservoir is above-normal.

Milk River Basin

Table 1 Water Supply Outlook as of March 1, 1993 - Milk River Basin (Natural Flows)

Locations	Volume Forecast for April 1 to September 30					1992 Actual May to September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Milk River at Milk River	77,000	62,000	80	50 - 100	30	21

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given;; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Water Storage Situation (continued)

Oldman River Basin

Table 2 Water Supply Outlook as of March 1, 1993 - Oldman River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May - September Volume as a % of Average
	Volume in Dam3	Volume in Acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
St. Mary River	620,000,	503,000	85	70 - 100	60	58
Belly River	200,000	162,000	80	70 -100	60	56
Waterton River	500,000	405,000	80	70 - 100	60	54
Oldman River near Brocket	720,000	584,000	65	50 - 90	40	50
Oldman River near Lethbridge	2,400,000	1,950,000	82	60 - 100	50	52

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 3 Status of Major Water Storage Reservoirs as of March 1, 1993 - Oldman River Basin

Reservoirs	Current Live Storage			Remarks	March 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as % of Maximum		dam3	acre-feet
Keho Lake	80,500	65,300	84	normal	79,000	64,000
Waterton Reservoir	60,300	48,900	53	normal	60,000	49,000
St. Mary Reservoir	266,000	216,000	72	normal	255,000	207,000
Ridge Reservoir	98,000	79,400	76	above-normal	85,000	69,000
Total	424,000	344,000	69	above-normal	400,000	325,000
Chin Reservoir	128,000	104,000	67	normal	162,000	131,000
Forty Mile Reservoir	84,400	68,000	98	normal	87,000	71,000
Total	212,000	172,000	77	normal	249,000	202,000
Oldman Reservoir	322,000	261,000	65	n/a	32,000	26,000

Water Storage Situation (continued)

Bow River Basin

Table 4 Water Supply Outlook as of March 1, 1993 - Bow River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May - September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Bow River at Banff	790,000	640,000	75	65 - 85	55	79
Bow River at Calgary	1,800,000	1,460,000	75	65 - 90	50	80
Elbow River	114,000	92,000	65	50 - 75	40	100
Highwood River	260,000	210,000	50	40 - 70	30	107
Lake Minnewanka Inflow	150,000	120,000	70	60 - 90	50	77
Spray Lake Inflow	240,000	195,000	75	65 - 90	55	82
Kananaskis River	300,000	243,000	75	65 - 90	50	47

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 5 Status of Major Water Storage Reservoirs as of March 1, 1993 - Bow River Basin

Reservoirs	Current Live Storage			Remarks	March 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Minnewanka	114,000	92,400	51	normal	112,000	91,000
Spray Lake	14,400	36,000	35	below-normal	33,000	27,000
Upper Kananaskis Lake	15,900	12,900	15	above-normal	14,000	11,000
Lower Kananaskis Lake	37,100	30,100	59	normal	36,000	29,000
Total	211,000	171,000	41	normal	195,000	158,000
Lake McGregor	306,000	248,000	96	normal	319,000	259,000
Travers Reservoir	70,000	56,500	67	normal	74,000	60,000
Total	376,000	305,000	88	normal	393,000	319,000
Lake Newell	154,500	125,000	87	normal	131,000	106,000
Crawling Valley Reservoir	102,000	82,700	91	normal	92,000	75,000
Total	257,000	208,000	89	normal	223,000	181,000

Water Storage Situation (continued)

Red Deer River Basin

Table 6 Water Supply Outlook as of March 1, 1993 - Red Deer River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May - September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Glennifer Lake	580,000	470,000	70	60 --90	50	101
Red Deer River at Red Deer	780,000	630,000	85	65 - 100	60	96

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 7 Status of Major Water Storage Reservoirs as of March 1, 1993 - Red Deer River Basin

Reservoirs	Current Live Storage			Remarks	March 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Glennifer Lake	129,000	104,000	64	normal	112,000	91,000

Water Storage Situation (continued)

North Saskatchewan River Basin

Table 8 Water Supply Outlook as of March 1, 1993 - North Saskatchewan River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May - September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Lake Abraham Inflow	1,780,000	1,440,000	83	75 - 90	70	92
Brazeau Reservoir Inflow	945,000	766,000	70	60 - 100	60	69
North Saskatchewan River at Edmonton	4,100,000	3,300,000	74	65 - 90	55	73

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 9 Status of Major Water Storage Reservoirs as of March 1, 1993 - North Saskatchewan River Basin

Reservoirs	Current Live Storage			Remarks	March 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Abraham	412,000	334,000	29	normal	441, 000	358,000
Brazeau Reservoir	106,000	86,000	22	normal	126,000	102,000
Total	518,000	420,000	27	normal	567,000	460,000

Groundwater Conditions

At present, groundwater levels for both shallow (less than 20 metres) and deep (greater than 20 metres) wells were generally below-normal in central, eastern and northern areas of the province. Levels were normal in southern areas.

Groundwater conditions have not changed since the beginning of February. Water levels in some shallow wells have fallen due to very little recharge reaching these aquifers during the fall and winter months.

The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of March 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	normal
Cypress Hills	below-normal	above-normal
Lethbridge	normal	normal
Calgary	below-normal	below-normal
Coronation-Brooks	below-normal	below-normal
Red Deer	normal	normal
Edson	normal	normal
Edmonton-Lloydminister	normal	below-normal
Whitecourt-Athabasca	below-normal	below-normal
Cold Lake	below-normal	below-normal
Grande Prairie-Peace River	normal	normal

Mountain Snowpack

For March 1st, snowpacks were much-below-average in the headwaters of the Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River and Smoky River basins (Figure 2). Record low mountain snowpacks were recorded at nearly all snow survey locations from the Highwood headwaters north to the Smoky River headwaters. Several of these mountain snow course measurements were much lower than the previous minimum on record. Conditions were below-average in the headwaters of the Oldman and Waterton/St. Mary River basins.

Mountain Snowpack Conditions as of March 1, 1993

Area	Snowpack Conditions (per cent of average)
Waterton/St. Mary River Headwaters	70 to 80
Oldman River Headwaters	60 to 80
Highwood/Kananaskis River headwaters	45 to 65
Bow River Headwaters	40 to 50
Red Deer River Headwaters	45 to 105
North Saskatchewan River Headwaters	40 to 50
Athabasca River Headwaters	40 to 55
Smoky River Headwaters	55 to 60

Winter 1992/1993 Weather Conditions

Winter precipitation (November 1, 1992, to February 28, 1993) was much-below-average in the mountain parks and the northern half of the province. Precipitation was closer to average for most of the southern and central Alberta plains (Figures 3 and 4).

February 1993 Weather Conditions

February precipitation was much-below average for most of the province (Figures 5 and 6). Many areas in central and northern Alberta had less than 50 percent of average precipitation for the month. Precipitation along the continental divide north of the Highwood River headwaters was also well below average. Chinook winds and above-normal temperatures at the beginning and end of February depleted the plains area snowpack considerably. Temperatures returned to normal by mid-month, when a disturbance brought a light snowfall to most of the province. Another snow fall in the third week brought about 10 cms to most of the central plains areas. Well above-average temperatures and Chinook winds at the end of February started active snowmelt for most of the plains areas of southern Alberta.

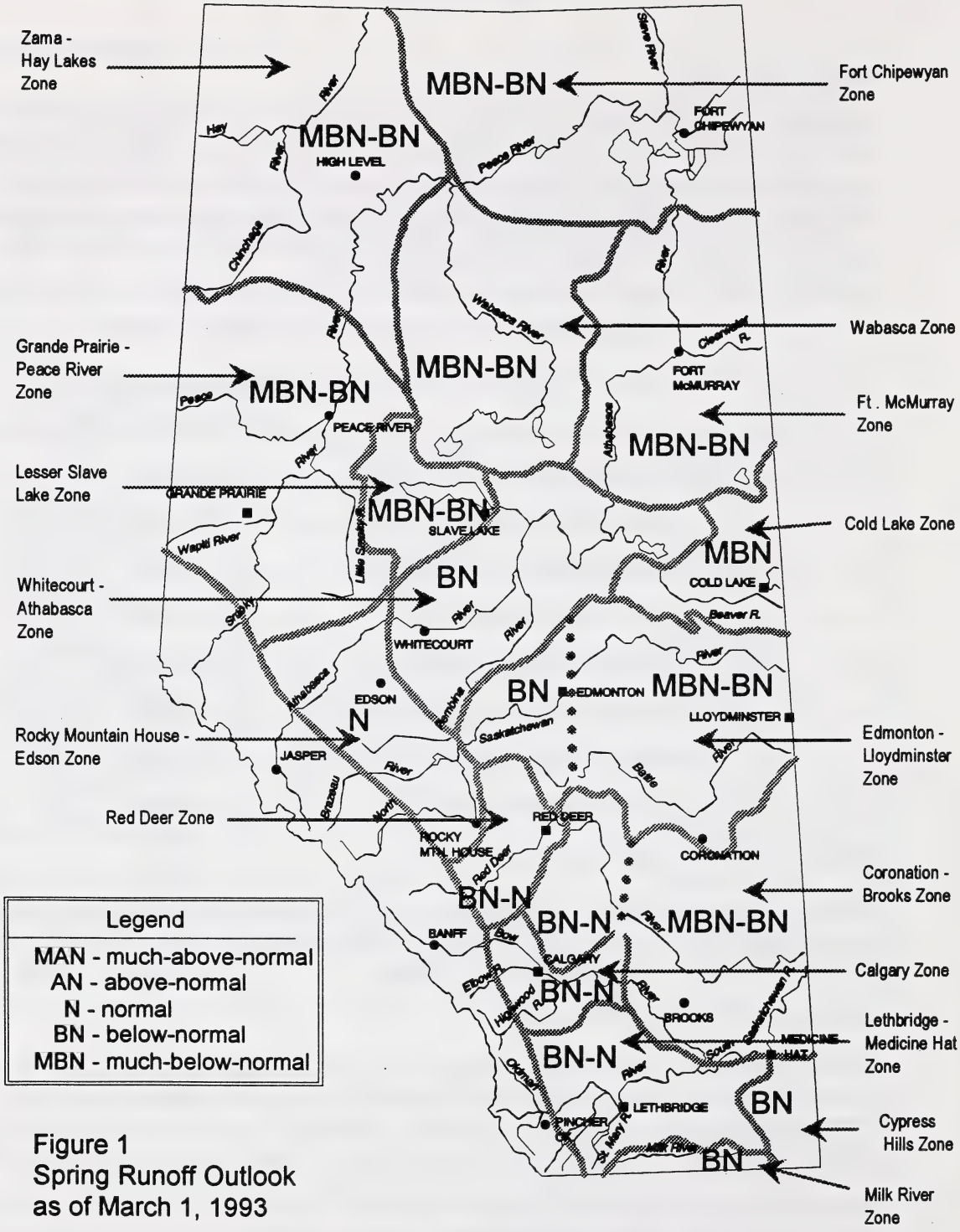


Figure 1
Spring Runoff Outlook
as of March 1, 1993

Alberta
ENVIRONMENTAL PROTECTION

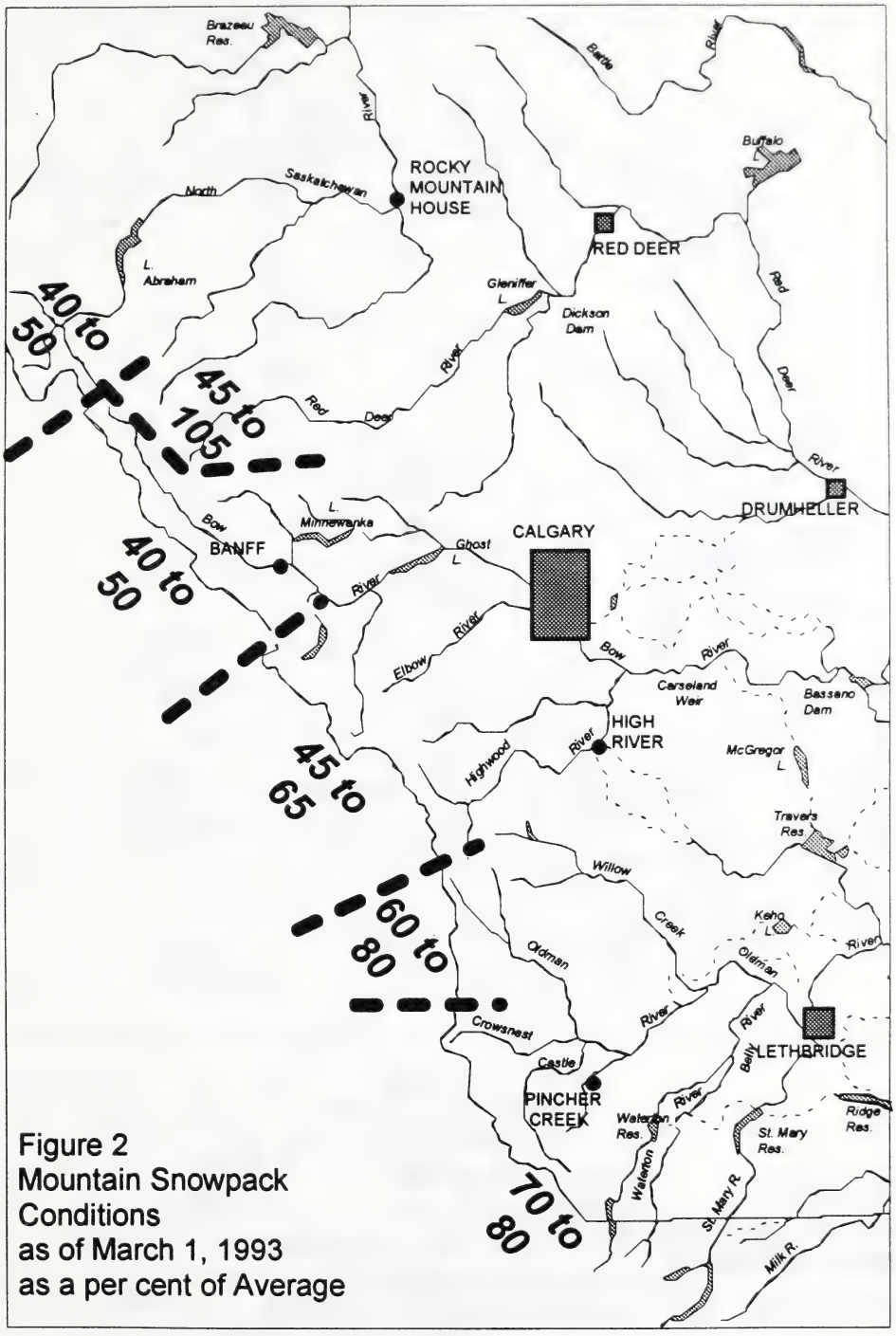


Figure 2
Mountain Snowpack Conditions
as of March 1, 1993
as a per cent of Average

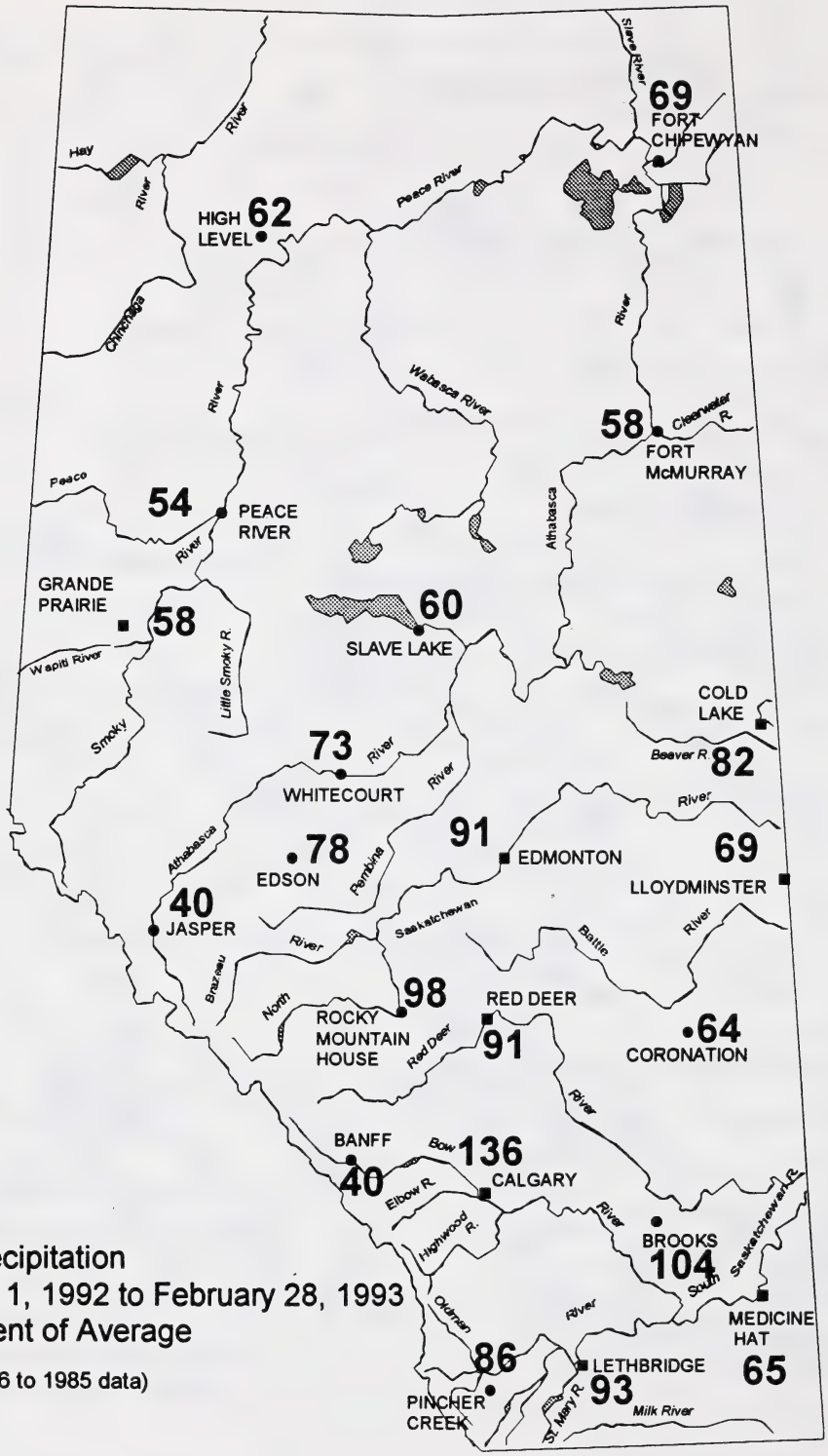


Figure 3
Winter Precipitation
November 1, 1992 to February 28, 1993
as a per cent of Average

(based on 1956 to 1985 data)

Alberta
ENVIRONMENTAL PROTECTION

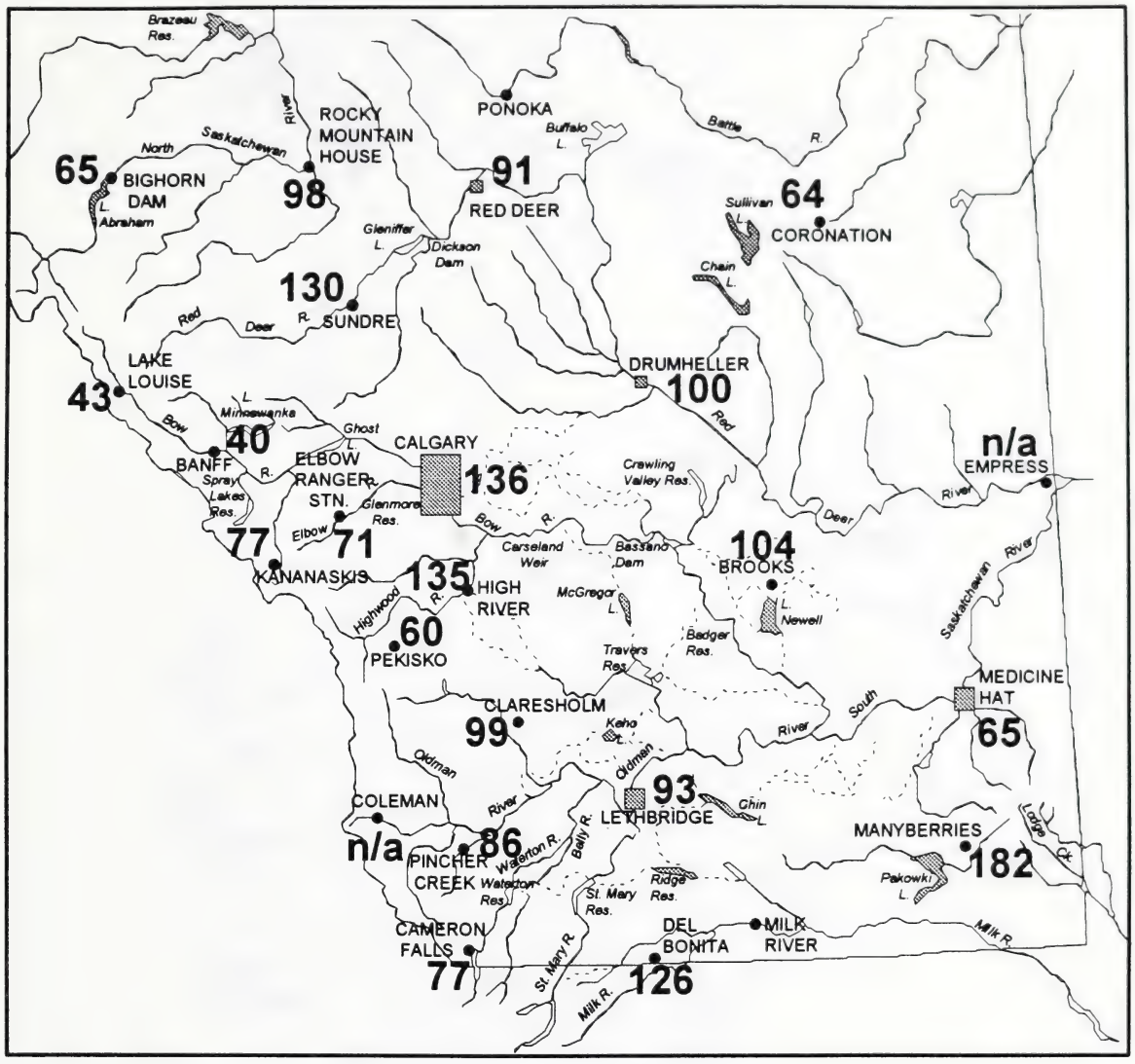


Figure 4
Winter Precipitation
Southern Alberta
November 1, 1992 to February 28, 1993
as a per cent of Average
(based on 1956 to 1985 data)

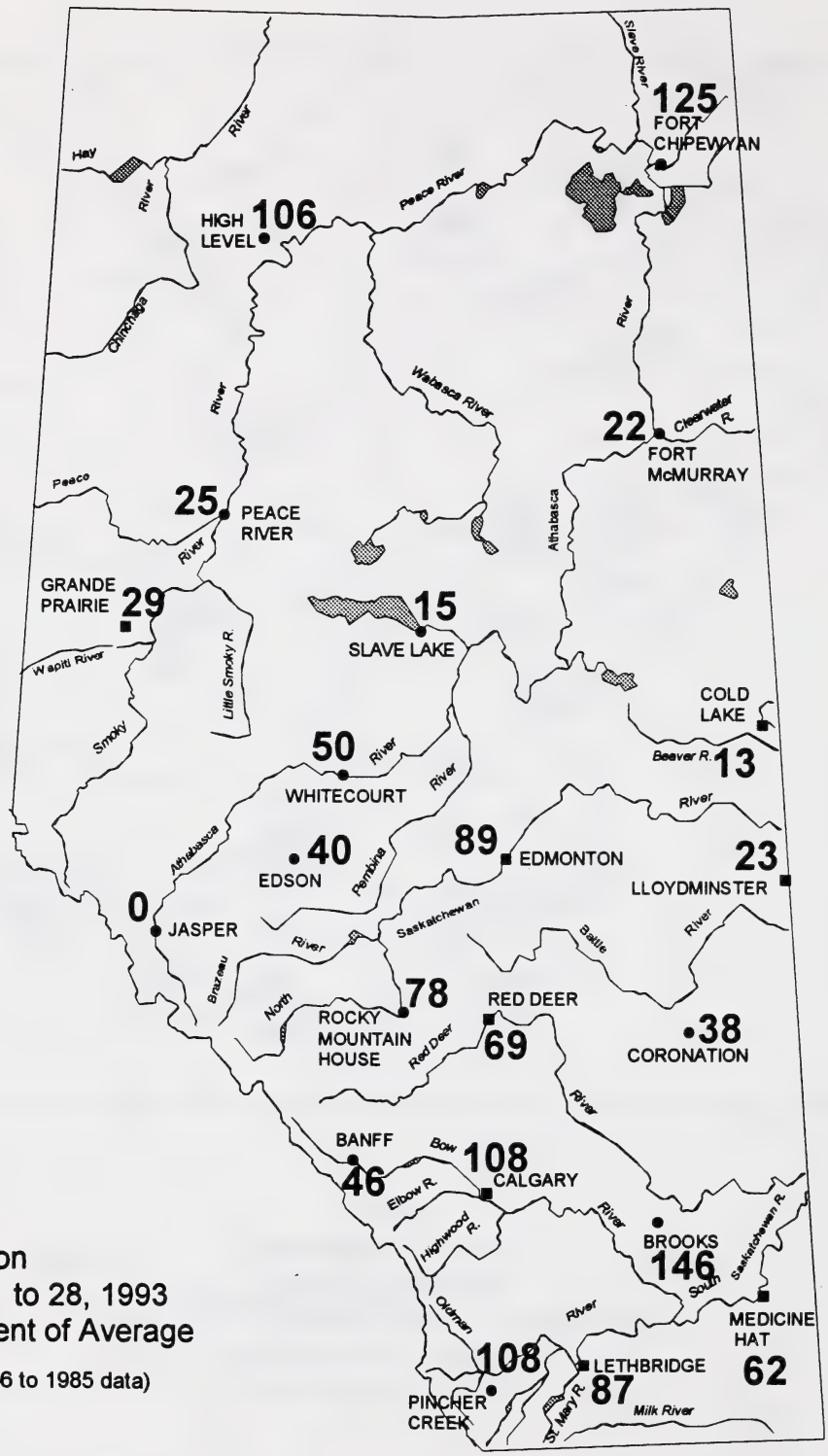


Figure 5
Precipitation
February 1 to 28, 1993
as a per cent of Average

(based on 1956 to 1985 data)

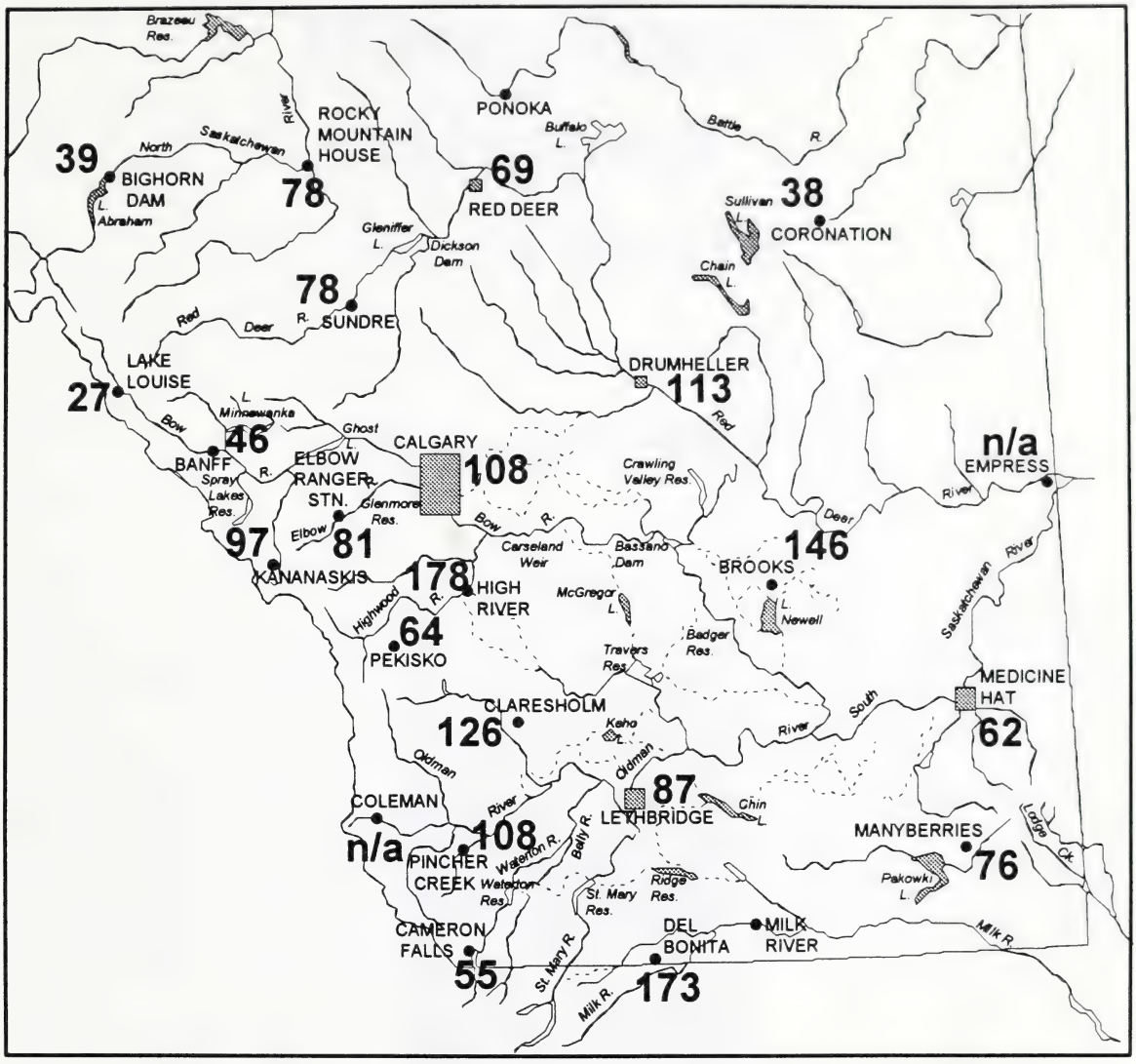
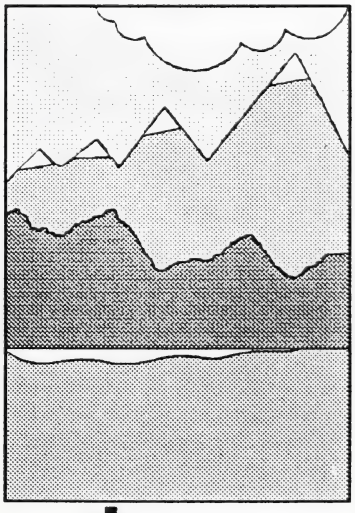


Figure 6
Precipitation
Southern Alberta
February 1 to 28, 1993
as a per cent of Average
(based on 1956 to 1985 data)

Water Supply Outlook for Alberta

April 1993



Alberta
ENVIRONMENTAL PROTECTION

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly, from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks. We also appreciate the assistance of a number of private citizens who diligently report observations of precipitation and other data.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

April 1993

Overview

The water supply outlook has improved slightly during the past month, but streamflow volumes are still expected to be much-below-average for the Bow, Red Deer, North Saskatchewan and Athabasca Rivers for the summer of 1993. Water supply conditions are forecast as below-average for the Oldman and Milk Rivers.

Mountain snowpacks continued much-below-average in the headwaters of the Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River and Smoky River basins. Conditions were below-average in the headwaters of the Oldman and Waterton/St. Mary River basins.

Because of the much-below-average snowpack at high elevations, mountain snow melt is expected to take place earlier than normal this year. Consequently, river levels are expected to recede sooner than usual this summer.

Spring runoff is in progress for most of the province. In general, runoff began about two to three weeks earlier than average. Most streams on the Alberta plains have reached their peak and are receding.

At present, groundwater levels are generally below-normal in central, eastern and northern areas of the province. Levels are normal in southern areas. There has been some spring recharge in the western parts of the province.

Winter precipitation was much-below-average in the mountain parks and the northern half of the province. Precipitation was average to above-average in the south-eastern areas and close to average for most of the southern and central Alberta plains.

An updated forecast of streamflow volumes for major streams in southern Alberta will be issued in early May. Precipitation between now and the end of September will greatly affect the summer water supply.

1993 Spring Snowmelt Runoff Outlook

Spring runoff is in progress for most of the province. In general, runoff began about two to three weeks earlier than average.

Most streams on the Alberta plains have reached their peak and are receding. Snowpack on southern Alberta plains was depleted with Chinook winds and above-average temperatures at the beginning of March. Nearly all the snowpack on the northern and north-central Alberta plains was gone by the end of March. As a result of much-below-average winter precipitation, there was very little runoff in the north.

Light to moderate snow cover still existed on the plains areas of Alberta at the end of March in the Whitecourt - Edmonton - Red Deer - Coronation area and a band along the foothills, extending from west of Calgary north to Grande Prairie.

Water Supply Volume Forecasts for the Summer of 1993

The natural streamflow volumes forecast for May to September 1993 have increased slightly since last month but are still expected to be much-below-average for the Bow, Red Deer and North Saskatchewan and Athabasca River basins. The streamflow volumes forecast for the Bow River basin are still near record lows. Because of the much-below-average snowpack at high elevations, the mountain snow melt is expected to occur earlier than normal, and river levels are expected to recede sooner than usual this summer. Below-average streamflow is forecast for the Oldman and Milk River basins. The volume forecasts are presented in the following table. The 1992 actual streamflow volumes are given for comparison.

Water Supply Volume Forecasts as of April 1, 1993

Location	May to September 1993 Natural Streamflow Volume Forecasts as a per cent of average	Actual Natural Streamflow Volumes May-September 1992 as a per cent of average
Milk River at Milk River*	85	21
Oldman River at Lethbridge	82	52
Bow River at Calgary	77	80
Red Deer River at Red Deer	80	96
North Saskatchewan River at Edmonton	79	73

* The value for Milk River is for the period April 1 to September 30.

Water Supply Volume Forecasts for the Summer of 1993 (continued)

Precipitation between now and the end of September will greatly affect the summer water supply. The streamflow volume forecasts will be updated monthly until mid-summer.

More detailed streamflow forecasts are presented in Tables 1,2,4,6 and 8.

Water Storage Situation

The water storage in most of the major hydroelectric reservoirs is normal (Tables 3,5,7 and 9). Upper Kananaskis Lake is above-normal and Spray Lake is below-normal.

The water storage in most of the major irrigation reservoirs is normal to above-normal. The Waterton, St. Mary, Ridge and Lake McGregor Reservoirs are above-normal.

Milk River Basin

Table 1 Water Supply Outlook as of April 1, 1993 - Milk River Basin (Natural Flows)

Locations	Volume Forecast for April 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Milk River at Milk River	81,600	66,200	85	55 - 110	30	21

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given;; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Oldman River Basin

Table 2 Water Supply Outlook as of April 1, 1993 - Oldman River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in Dam3	Volume in Acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
St. Mary River	618,000	501,000	85	70 - 100	60	58
Belly River	196,000	189,000	80	70 - 100	60	56
Waterton River	501,000	406,000	80	70 - 100	60	54
Oldman River Dam Inflow	723,000	586,000	65	50 - 90	40	50
Oldman River near Lethbridge	2,400,000	1,950,000	82	60 - 100	50	52

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 3 Status of Major Water Storage Reservoirs as of April 1, 1993
Oldman River Basin

Reservoirs	Current Live Storage			Remarks	April 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as % of Maximum		dam3	acre-feet
Keho Lake	80,900	65,600	85	normal	77,000	62,000
Waterton Reservoir	63,100	51,200	55	above-normal	61,000	49,000
St. Mary Reservoir	277,000	225,000	75	above-normal	256,000	208,000
Ridge Reservoir	102,000	82,700	79	above-normal	84,000	68,000
Total	442,000	359,000	72	above-normal	401,000	325,000
Chin Reservoir	132,000	107,000	69	normal	164,000	133,000
Forty Mile Reservoir	84,500	68,500	98	normal	87,000	71,000
Total	216,000	176,000	78	normal	251,000	204,000
Oldman Reservoir	339,000	275,000	68	n/a	34,000	28,000

Bow River Basin

Table 4 Water Supply Outlook as of April 1, 1993 - Bow River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Bow River at Banff	798,000	647,000	76	65 - 85	55	79
Bow River at Calgary	1,830,000	1,480,000	77	65 - 90	50	80
Elbow River	125,000	101,000	70	50 - 80	45	100
Highwood River	285,000	231,000	55	40 - 80	30	107
Lake Minnewanka Inflow	161,000	130,000	75	65 - 95	55	77
Spray Lake Inflow	319,000	259,000	77	65 - 90	55	82
Kananaskis River	307,000	249,000	77	65 - 90	50	47

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 5 Status of Major Water Storage Reservoirs as of April 1, 1993 - Bow River Basin

Reservoirs	Current Live Storage			Remarks	April 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Minnewanka	93,900	76,100	42	normal	94,000	76,000
Spray Lake	24,200	19,600	19	below-normal	12,000	9,700
Upper Kananaskis Lake	9,960	8,100	10	above-normal	5,300	4,300
Lower Kananaskis Lake	19,400	15,800	31	normal	20,000	16,000
Total	147,000	119,000	29	normal	131,000	106,000
Lake McGregor	310,000	251,000	97	above-normal	314,000	255,000
Travers Reservoir	74,100	60,100	71	normal	66,000	54,000
Total	385,000	312,000	91	above-normal	380,000	309,000
Lake Newell	155,000	125,000	87	normal	133,000	108,000
Crawling Valley Reservoir	102,000	82,700	91	normal	92,000	75,000
Total	257,000	208,000	89	normal	225,000	183,000

Red Deer River Basin

Table 6 Water Supply Outlook as of April 1, 1993 - Red Deer River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Glennifer Lake	620,000	503,000	75	60 - 90	50	101
Red Deer River at Red Deer	832,000	675,000	80	65 - 100	60	96

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 7 Status of Major Water Storage Reservoirs as of April 1, 1993 - Red Deer River Basin

Reservoirs	Current Live Storage			Remarks	April 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Glennifer Lake	136,000	110,000	67	normal	111,000	90,000

North Saskatchewan River Basin

Table 8 Water Supply Outlook as of April 1, 1993 - North Saskatchewan River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Lake Abraham Inflow	1,830,000	1,480,000	85	75 - 90	70	92
Brazeau Reservoir Inflow	1,010,000	819,000	75	60 - 100	60	69
North Saskatchewan River at Edmonton	4,380,000	3,550,000	79	65 - 90	55	73

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 9 Status of Major Water Storage Reservoirs as of April 1, 1993 - North Saskatchewan River Basin

Reservoirs	Current Live Storage			Remarks	April 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Abraham	244,000	198,000	17	normal	258, 000	209,000
Brazeau Reservoir	36,400	29,500	7	normal	82,000	66,000
Total	280,000	228,000	15	normal	340,000	275,000

Groundwater Conditions

At present, groundwater levels for both shallow (less than 20 metres) and deep (greater than 20 metres) wells were generally below-normal in central, eastern and northern areas of the province. Levels were normal in southern areas.

Groundwater conditions have not changed much since the beginning of March. There has been some spring recharge in the western parts of the province. In general, water levels in some shallow wells have fallen due to very little recharge reaching these aquifers during the fall and winter months.

The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of April 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	normal
Cypress Hills	below-normal	above-normal
Lethbridge	normal	normal
Calgary	below-normal	below-normal
Coronation-Brooks	below-normal	below-normal
Red Deer	normal	normal
Edson	normal	normal
Edmonton-Lloydminister	normal	below-normal
Whitecourt-Athabasca	below-normal	below-normal
Cold Lake	below-normal	below-normal
Grande Prairie-Peace River	normal	normal

Mountain Snowpack

As of April 1st, mountain snowpacks continued much-below-average in the headwaters of the Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River and Smoky River basins (Figure 1). Again, record low mountain snowpacks were recorded at nearly all snow survey locations from the Highwood headwaters north to the Smoky River headwaters. Several of these mountain snow course measurements were much lower than the previous minimum on record. Conditions were below-average in the headwaters of the Oldman and Waterton/St. Mary River basins.

Mountain Snowpack Conditions as of April 1, 1993

Area	Snowpack Conditions (per cent of average)
Waterton/St. Mary River Headwaters	65 to 80
Oldman River Headwaters	65 to 75
Highwood/Kananaskis River headwaters	55 to 70
Bow River Headwaters	50 to 60
Red Deer River Headwaters	55 to 105
North Saskatchewan River Headwaters	50 to 65
Athabasca River Headwaters	50 to 65
Smoky River Headwaters	60 to 70

Winter 1992/1993 Weather Conditions

Winter precipitation (November 1, 1992, to March 31, 1993) was much-below-average in the mountain parks and the northern half of the province. Precipitation was average to above-average in the south-eastern areas and close to average for most of the southern and central Alberta plains (Figures 2 and 3).

March 1993 Weather Conditions

March precipitation was much-below-average in the north and north-central areas and much-above-average along the foothills, mountains and southeastern areas of the province (Figures 4 and 5).

March came in like a lamb and went out like a lamb. Well above-average temperatures and Chinook winds at the beginning of March started active snow melt for most of the plains areas of southern Alberta. This depleted plains area snowpack in southern Alberta and nearly depleted it on the central Alberta plains. A late winter snowstorm in the second week brought heavy snowfalls to central Alberta, with up to 25 cms on the plains.

In the third week, another late winter snowstorm brought heavy snowfall to southern Alberta; 20 to 60 cms along the foothills This snow fall was the heaviest in the Waterton - St. Mary - Belly River headwaters. Spring runoff stopped with below-average temperatures around most of the province.

After the first day of spring, record high temperatures in the north and Chinook conditions in the south brought a spring thaw. Snow cover on the plains and foothills melted rapidly in most areas. This rapid warming trend caused streams to increase moderately in southern Alberta. Spring runoff was active, again, in most of the province.

In the last week, colder weather caused streamflow to decrease and a spring snowstorm brought up to 20 cms of snow in the Bow and Red Deer River headwaters and the Medicine Hat - Coronation areas. Warmer weather right at the end of March caused streamflows to begin rising again.

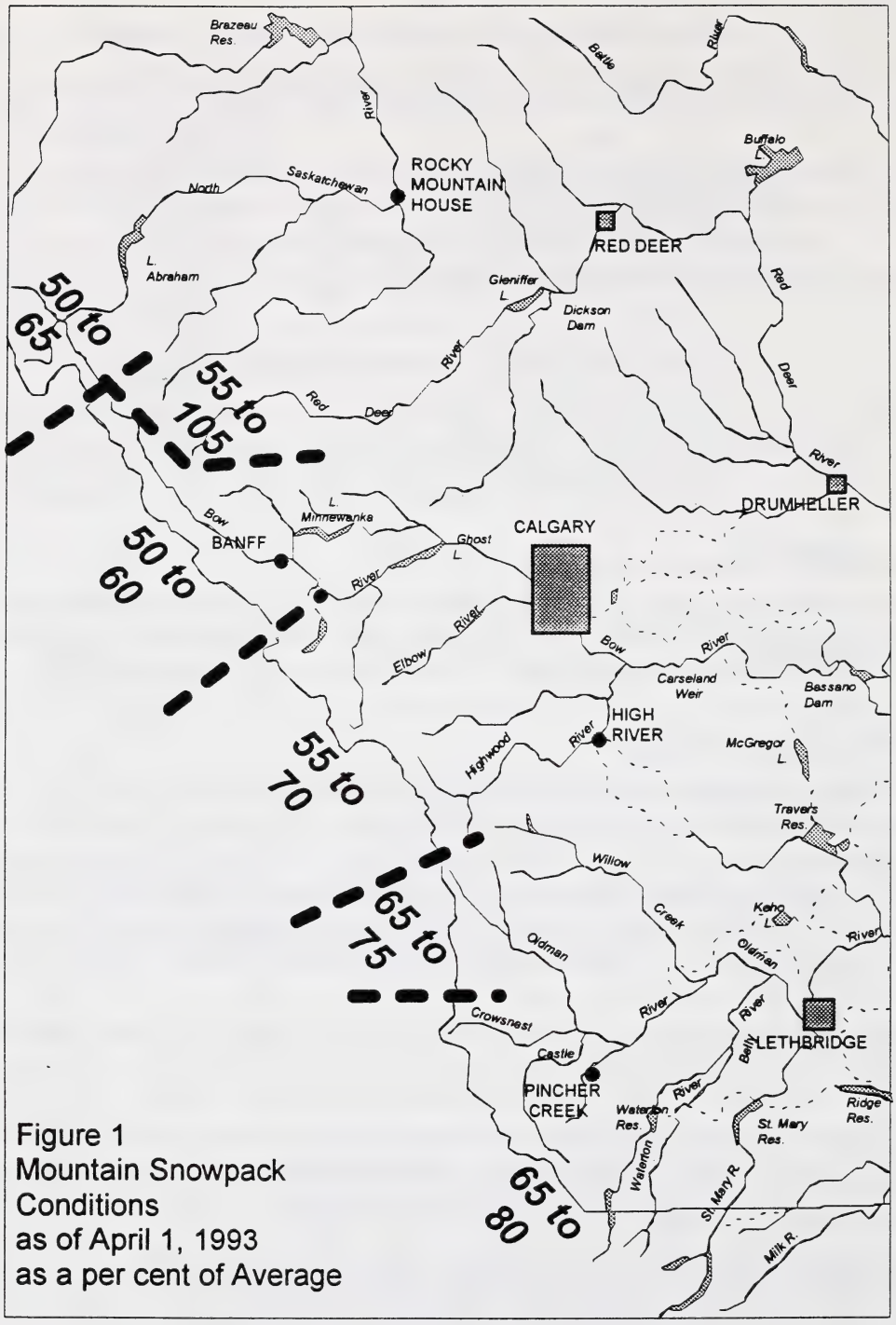


Figure 1
Mountain Snowpack Conditions
as of April 1, 1993
as a per cent of Average

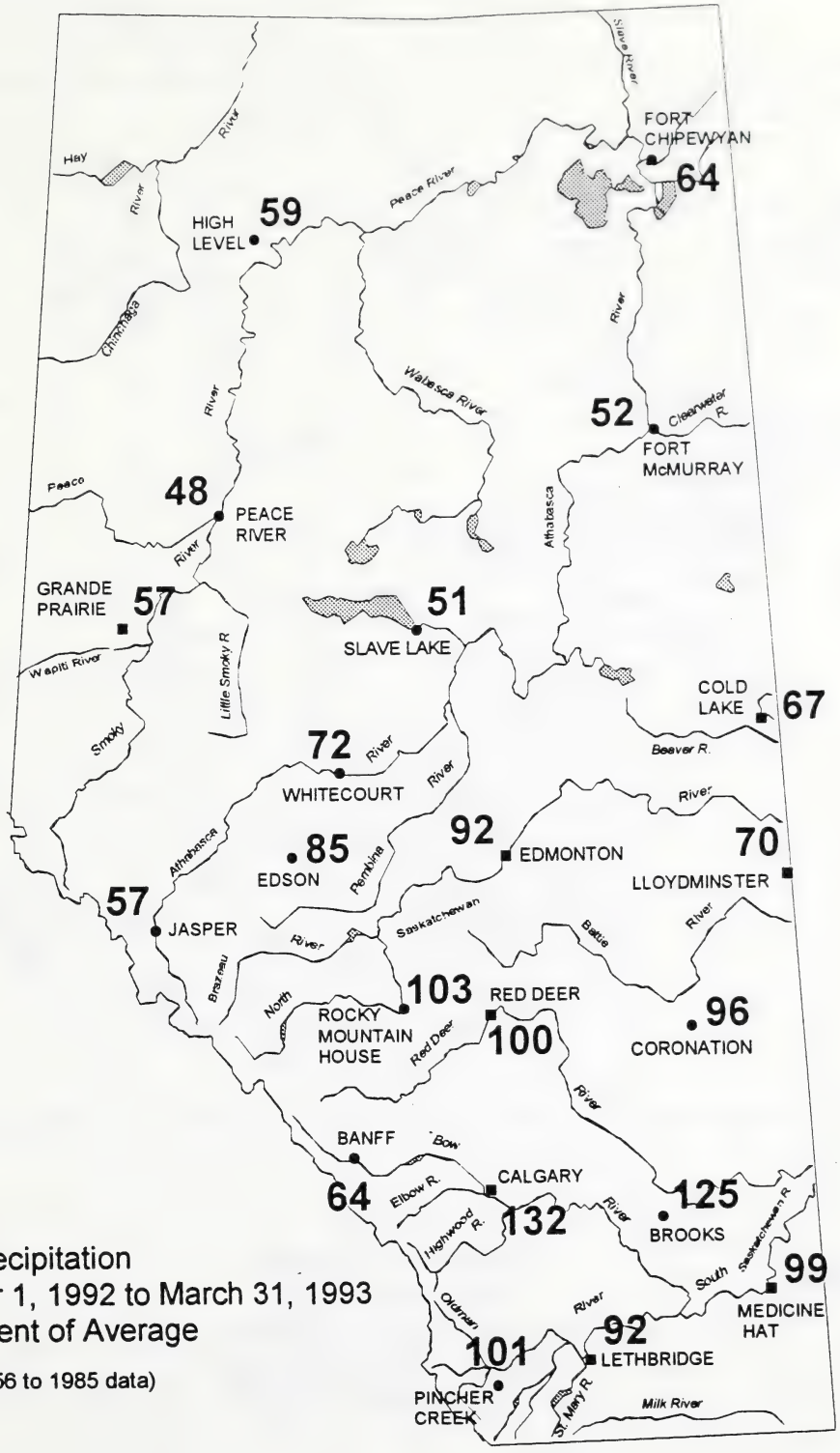


Figure 2
Winter Precipitation
November 1, 1992 to March 31, 1993
as a per cent of Average

(based on 1956 to 1985 data)

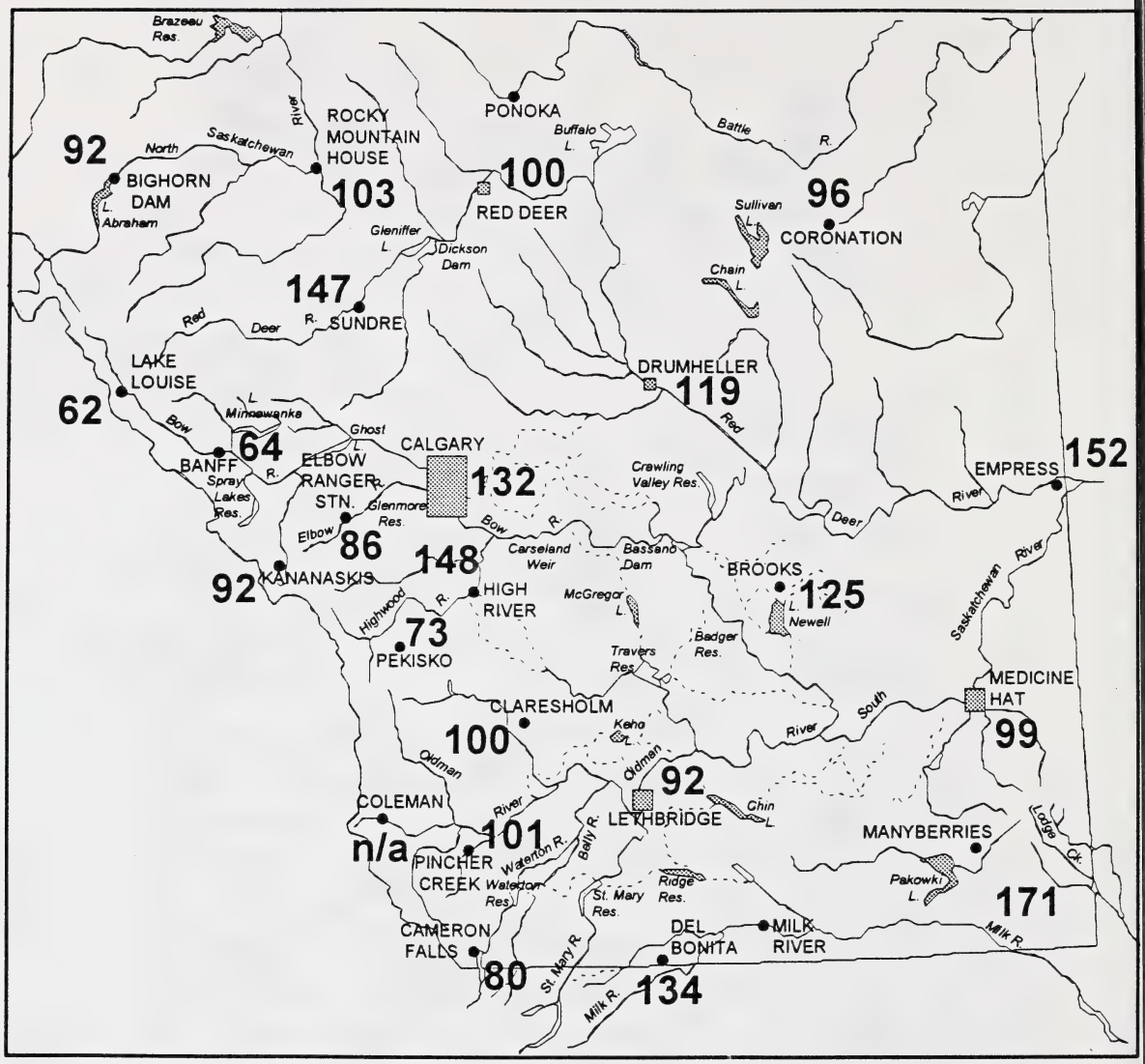


Figure 3
Winter Precipitation
Southern Alberta
November 1, 1992 to March 31, 1993
as a per cent of Average
(based on 1956 to 1985 data)

Alberta
ENVIRONMENTAL PROTECTION

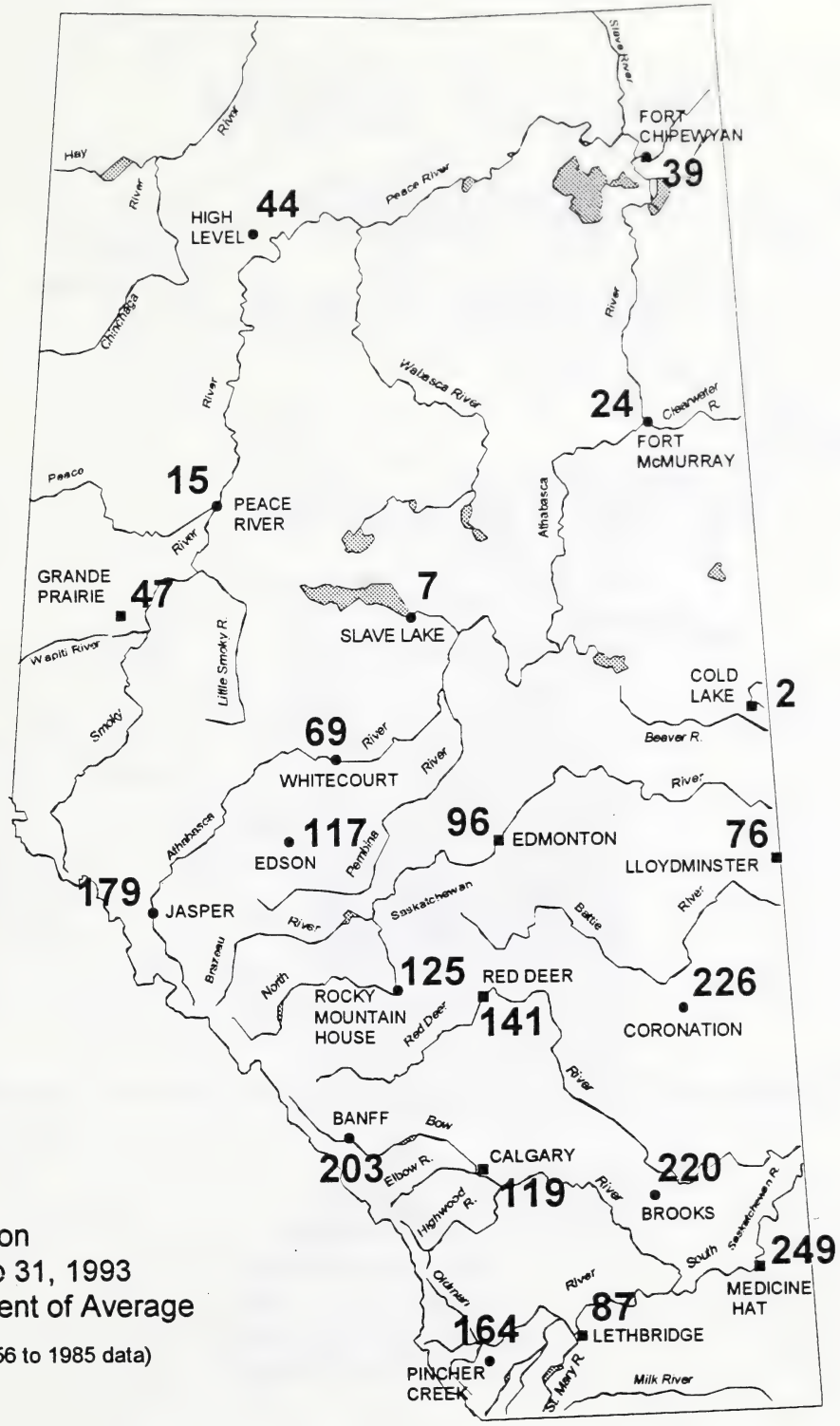


Figure 4
Precipitation
March 1 to 31, 1993
as a per cent of Average

(based on 1956 to 1985 data)

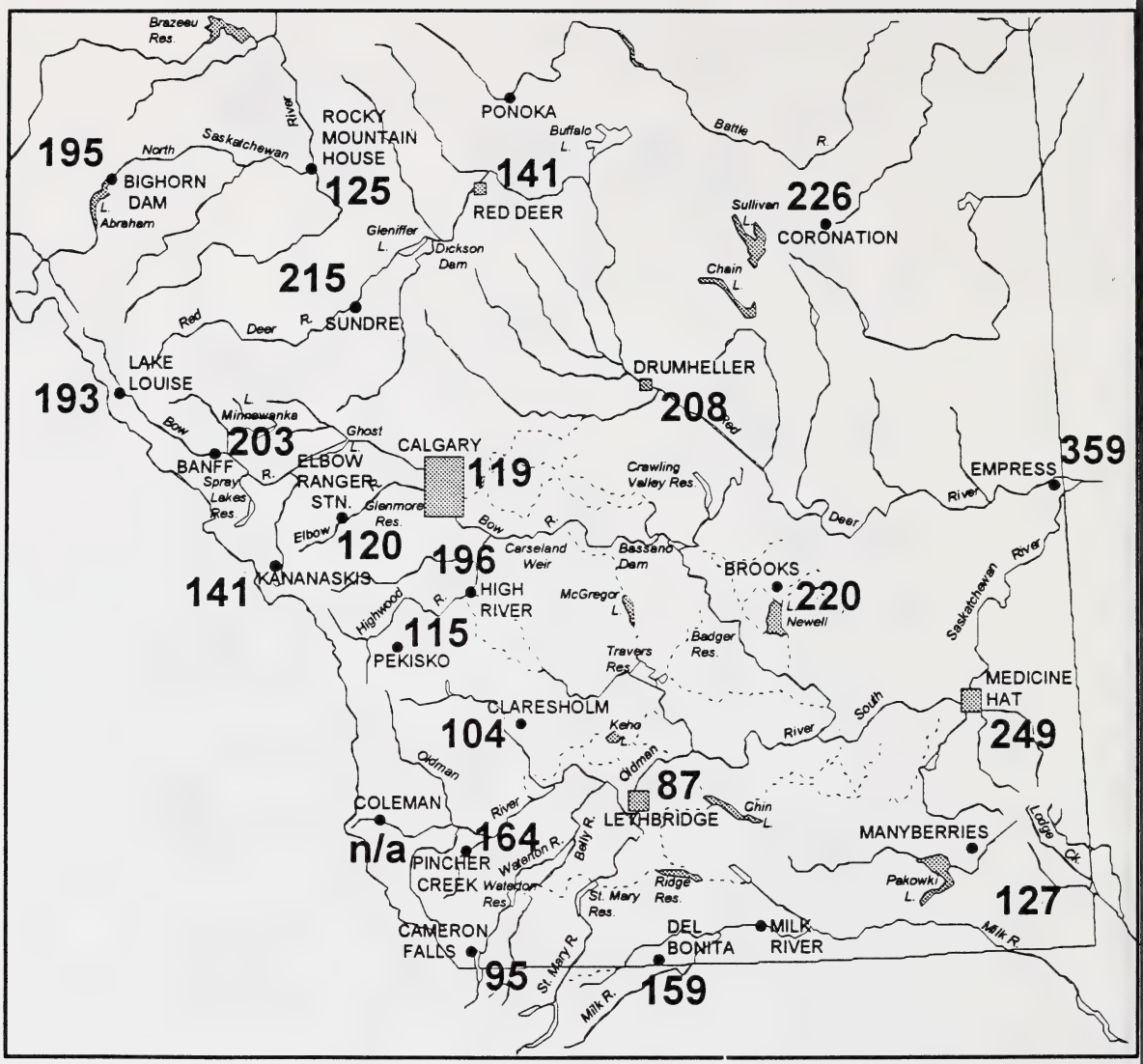
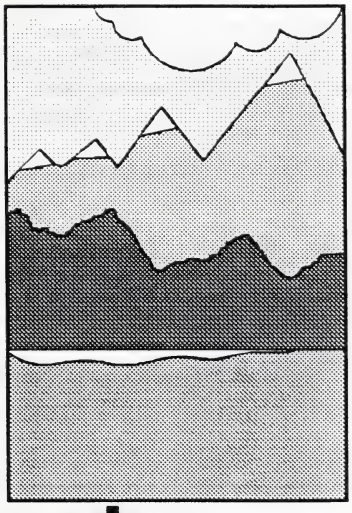


Figure 5
Precipitation
Southern Alberta
March 1 to 31, 1993
as a per cent of Average
(based on 1956 to 1985 data)

Water Supply Outlook for Alberta

May 1993



Alberta
ENVIRONMENTAL PROTECTION

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly, from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks. We also appreciate the assistance of a number of private citizens who diligently report observations of precipitation and other data.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

May 1993

Overview

The water supply outlook has continued to improve slightly over the past month in the headwaters of the Bow River basin. The water supply forecast for the headwaters of the Oldman River basin has decreased slightly. Streamflow volumes are still expected to be much-below-average for the Bow, North Saskatchewan and Athabasca Rivers for the summer of 1993. Water supply conditions are forecast as below-average for the Red Deer, Oldman and Milk Rivers.

So far spring weather has been rather cool, with no extended periods of warm weather to cause much snow melt in the mountains. As of May 1st, mountain snowpacks were still much-below-average in the headwaters of the Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River basins. Record low mountain snowpacks were recorded at many snow survey locations from the headwaters in the northern portion of the Bow River basin north to the Athabasca River headwaters. The mountain snow conditions continued below-average in the headwaters of the Oldman and Waterton/St. Mary River basins.

Because of the much-below-average snowpack at high elevations, peak mountain snow melt is expected to take place earlier than normal this year. Consequently, river levels are still expected to recede sooner than usual this summer.

There has been some recharge of groundwater levels after the spring thaw. At present, groundwater levels for both shallow and deep wells are generally below-normal in most northeastern, central and northern areas of the province. Levels in shallow wells in southern areas are below-normal to normal. Deep well levels in the south ranged from below-normal to above-normal.

Winter precipitation was much-below-average in the mountain parks and the northern half of the province. Precipitation was average to above-average in the southeastern areas and close to average for most of the southern and central Alberta plains.

The mountains and foothills areas had 75 to 90 per cent of average precipitation in April. The most significant April precipitation was in east central and southeast Alberta where precipitation for the month was much-above-average.

The ice break up on the Athabasca River at Ft. McMurray was monitored closely for flooding potential and no problems were encountered this year. Ice broke up on April 19 on the Athabasca River at Ft. McMurray.

An updated forecast of streamflow volumes for major streams in southern Alberta will be issued in early June. Precipitation between now and the end of September will affect the summer water supply.

Water Supply Volume Forecasts for the Summer of 1993

The water supply outlook has continued to improved slightly over the past month in the headwaters of the Bow River basin. The water supply forecast for the headwaters of the Oldman River basin has decreased slightly. Streamflow volumes are still expected to be much-below-average for the Bow, North Saskatchewan and Athabasca Rivers for the summer of 1993. Water supply conditions are forecast as below-average for the Red Deer, Oldman and Milk Rivers.

The volume forecasts are presented in the following table. The 1992 actual streamflow volumes are given for comparison.

Water Supply Volume Forecasts as of May 1, 1993

Location	May to September 1993 Natural Streamflow Volume Forecasts as a per cent of average	Actual Natural Streamflow Volumes May-September 1992 as a per cent of average
Milk River at Milk River*	75	21
Oldman River at Lethbridge	75	52
Bow River at Calgary	78	80
Red Deer River at Red Deer	80	96
North Saskatchewan River at Edmonton	75	73

* The value for Milk River is for the period April 1 to September 30.

Because of the much-below-average snowpack at high elevations, peak mountain snow melt is expected to occur earlier than normal. Consequently river levels are still expected to recede sooner than usual this summer.

Precipitation between now and the end of September will affect the summer water supply. The streamflow volume forecasts will be updated monthly until mid-summer.

More detailed streamflow forecasts are presented in Tables 1,2,4,6 and 8.

Water Storage Situation

The water storage in most of the major hydroelectric reservoirs is normal (Tables 3,5,7 and 9). Upper and Lower Kananaskis Lakes are above-normal.

The water storage in most of the major irrigation reservoirs normal to above-normal. The St. Mary, Ridge, Lake Newell and Lake McGregor Reservoirs are above-normal. The Waterton Reservoir is below-normal.

Milk River Basin

Table 1 Water Supply Outlook as of May 1, 1993 - Milk River Basin (Natural Flows)

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Milk River at Milk River	72,000	58,000	75	50-100	30	21

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given;; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Oldman River Basin

Table 2 Water Supply Outlook as of May 1, 1993 - Oldman River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in Dam3	Volume in Acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
St. Mary River	580,000	470,000	80	65-95	55	58
Belly River	185,000	150,000	75	60-90	50	56
Waterton River	470,000	380,000	75	60-90	50	54
Oldman River Dam Inflow	720,000	580,000	65	50-85	40	50
Oldman River near Lethbridge	2,200,000	1,780,000	75	60-90	50	52

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 3 Status of Major Water Storage Reservoirs as of May 1, 1993 Oldman River Basin

Reservoirs	Current Live Storage			Remarks	May 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as % of Maximum		dam3	acre-feet
Keho Lake	82,000	66,400	86	normal	76,600	62,000
Waterton Reservoir	49,500	40,100	43	below-normal	22,800	18,500
St. Mary Reservoir	301,000	244,000	82	above-normal	223,000	181,000
Ridge Reservoir	103,000	83,500	80	above-normal	108,000	88,000
Total	535,000	434,000	88	normal	354,000	288,000
Chin Reservoir	160,000	130,000	84	normal	171,000	139,000
Forty Mile Reservoir	84,500	68,500	98	normal	82,000	66,000
Total	245,000	199,000	89	normal	253,000	205,000
Oldman Reservoir	386,000	313,000	78	n/a	47,000	38,000

Bow River Basin

Table 4 Water Supply Outlook as of May 1, 1993 - Bow River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Bow River at Banff	840,000	680,000	80	70-90	60	79
Bow River at Calgary	1,840,000	1,490,000	78	70-95	65	80
Elbow River	150,000	120,000	75	60-90	50	100
Highwood River	335,000	270,000	65	55-85	40	107
Lake Minnewanka Inflow	170,000	138,000	80	65-95	55	77
Spray Lake Inflow	245,000	200,000	77	65-90	60	82
Kananaskis River	320,000	260,000	80	65-95	60	47

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 5 Status of Major Water Storage Reservoirs as of May 1, 1993 - Bow River Basin

Reservoirs	Current Live Storage			Remarks	May 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Minnewanka	81,200	65,800	36	normal	75,000	61,000
Spray Lake	15,300	12,400	9	n/a*	140	113
Upper Kananaskis Lake	9,300	7,500	9	above-normal	5,300	4,300
Lower Kananaskis Lake	6,900	5,600	11	above-normal	8,700	7,100
Total	113,000	91,000	20	normal	89,100	72,500
Lake McGregor	306,000	248,000	96	above-normal	291,000	236,000
Travers Reservoir	102,000	82,700	98	normal	115,000	93,000
Total	408,000	331,000	96	above-normal	406,000	329,000
Lake Newell	178,000	144,000	100	above-normal	158,000	128,000
Crawling Valley Reservoir	103,000	83,500	91	normal	91,000	74,000
Total	281,000	228,000	96	above-normal	249,000	202,000

* The full supply line (FSL) for Spray Lake has increased from 1694.7 to 1697.7m, January 1993.

Red Deer River Basin

Table 6 Water Supply Outlook as of May 1, 1993 - Red Deer River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Glennifer Lake	620,000	500,000	75	60-90	50	101
Red Deer River at Red Deer	830,000	670,000	80	65-100	60	96

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 7 Status of Major Water Storage Reservoirs as of May 1, 1993 - Red Deer River Basin

Reservoirs	Current Live Storage			Remarks	May 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Glennifer Lake	141,000	114,000	69	normal	94,000	76,000

North Saskatchewan River Basin

Table 8 Water Supply Outlook as of May 1, 1993 - North Saskatchewan River Basin

Locations	Volume Forecast for May 1 to September 30					1992 Actual May-September Volume as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Lake Abraham Inflow	1,830,000	1,480,000	85	75-90	70	92
Brazeau Reservoir Inflow	1,010,000	820,000	75	60-100	60	69
North Saskatchewan River at Edmonton	4,150,000	3,360,000	75	60-90	55	73

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation in the coming spring and summer months.

Table 9 Status of Major Water Storage Reservoirs as of May 1, 1993 - North Saskatchewan River Basin

Reservoirs	Current Live Storage			Remarks	May 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Abraham	107,000	86,700	8	normal	78, 000	63,000
Brazeau Reservoir	33,000	26,800	7	normal	20,000	16,000
Total	140,000	114,000	7	normal	98,000	79,000

Groundwater Conditions

There has been some recharge of groundwater levels after the spring thaw. At present, groundwater levels for both shallow (less than 20 metres) and deep (greater than 20 metres) wells are generally below-normal in most northeastern, central and northern areas of the province. Levels in shallow wells in southern areas are below-normal to normal. Deep well levels in the south ranged from below-normal to above-normal.

The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of May 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	below-normal
Cypress Hills	below-normal	above-normal
Lethbridge	normal	above-normal
Calgary	below-normal	below-normal
Coronation-Brooks	below-normal	below-normal
Red Deer	below-normal	below-normal
Edson	normal	normal
Edmonton-Lloydminister	below-normal	below-normal
Whitecourt-Athabasca	normal	below-normal
Cold Lake	below-normal	normal
Grande Prairie-Peace River	normal	normal

Mountain Snowpack

So far spring weather has been rather cool, with no extended periods of warm weather to cause much snow melt in the mountains. As of May 1st, mountain snowpacks were still much-below-average in the headwaters of the Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River basins (Figure 1). Record low mountain snowpacks were recorded at many snow survey locations from the northern portion of the Bow River basin north to the Athabasca River headwaters. The mountain snow conditions continued below-average in the headwaters of the Oldman and Waterton/St. Mary River basins.

Mountain Snowpack Conditions as of May 1, 1993

Area	Snowpack Conditions (per cent of average)
Waterton/St. Mary River Headwaters	60 to 85
Oldman River Headwaters	60 to 85
Highwood/Kananaskis River Headwaters	60 to 80
Bow River Headwaters	60 to 70
Red Deer River Headwaters	60 to 70
North Saskatchewan River Headwaters	50 to 65
Athabasca River Headwaters	60 to 75

Winter 1992/1993 Weather Conditions

Winter precipitation (November 1, 1992, to April 30, 1993) was much-below-average in the mountain parks and the northern half of the province. Precipitation was average to above-average in the south-easternareas and close to average for most of the southern and central Alberta plains (Figures 2 and 3).

April 1993 Weather Conditions

April was rather cool and unsettled with three spring storms on the plains and no long periods of warm temperatures. The mountains and foothills areas had 75 to 90 per cent of average precipitation in April. The most significant April precipitation was in east central and southeast Alberta where precipitation for the month was much-above-average. April precipitation was also much-above-average in the Grande Prairie - Peace River - Slave Lake - Cold Lake areas. In the far north, precipitation continued to be much-below-average (Figures 4 and 5).

In the first week of April, a spring snow storm spread heavy wet snow over much of central and southern Alberta. Precipitation from this storm was 10 to 20 mm in east central areas, 20 to 40 mm in south eastern areas and up to 20 mm in the foothills and mountains west of Lethbridge and Calgary. A second spring storm starting on the Easter weekend brought another 10 mm of precipitation, centered mostly over the Edmonton area. Streamflows in southern and central Alberta fell slowly with cool and wet weather over most of the area. Another third spring snow storm in central Alberta brought more precipitation in the east central and north central areas. There was some thundershower activity in several areas around the province at mid month. Streams rose steadily as warmer weather returned in the third week of the month. Mixed rain and snow in the mountain headwaters at the end of the month caused streams with mountain headwaters to rise slowly.

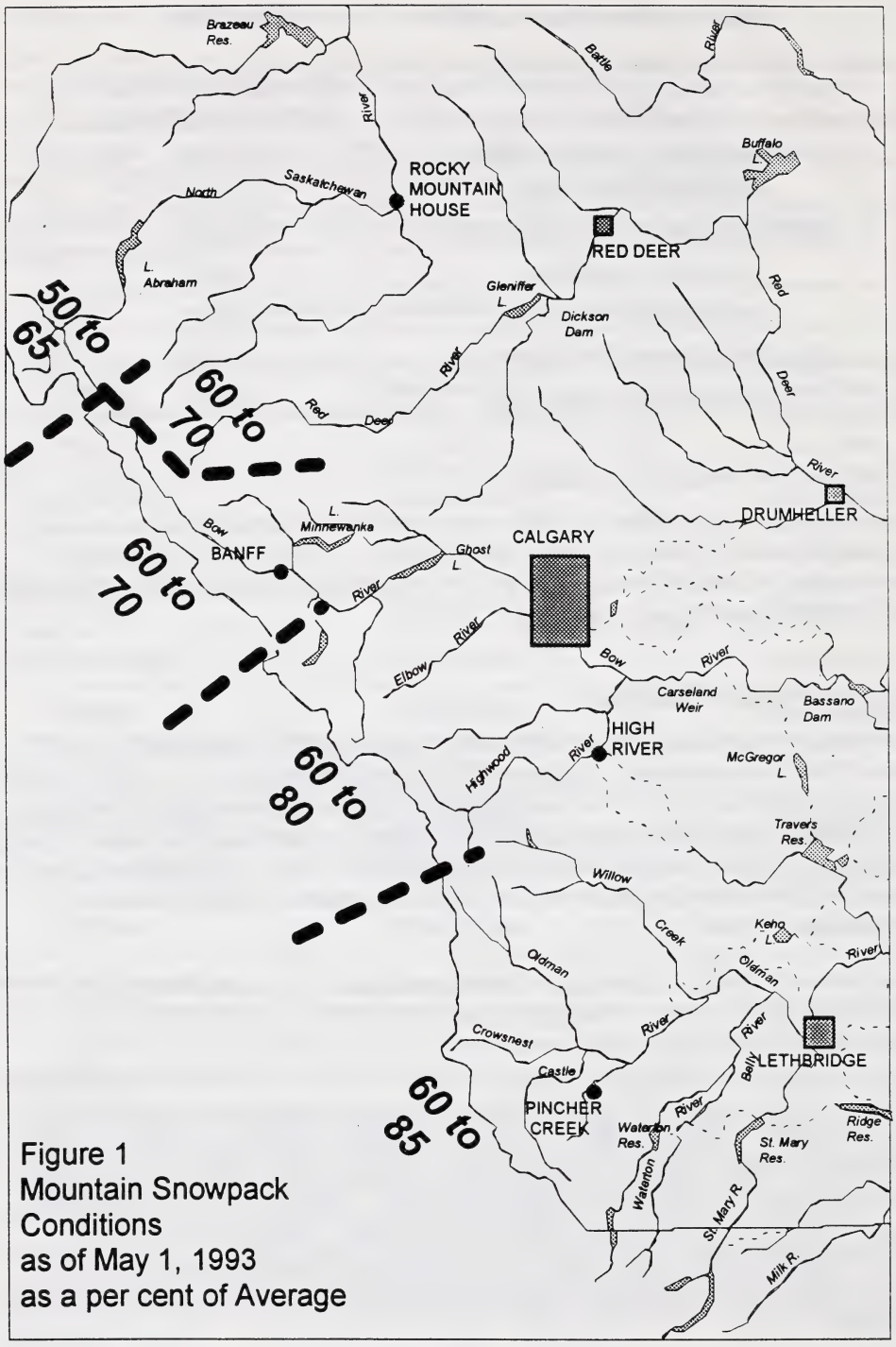


Figure 1
Mountain Snowpack Conditions
as of May 1, 1993
as a per cent of Average

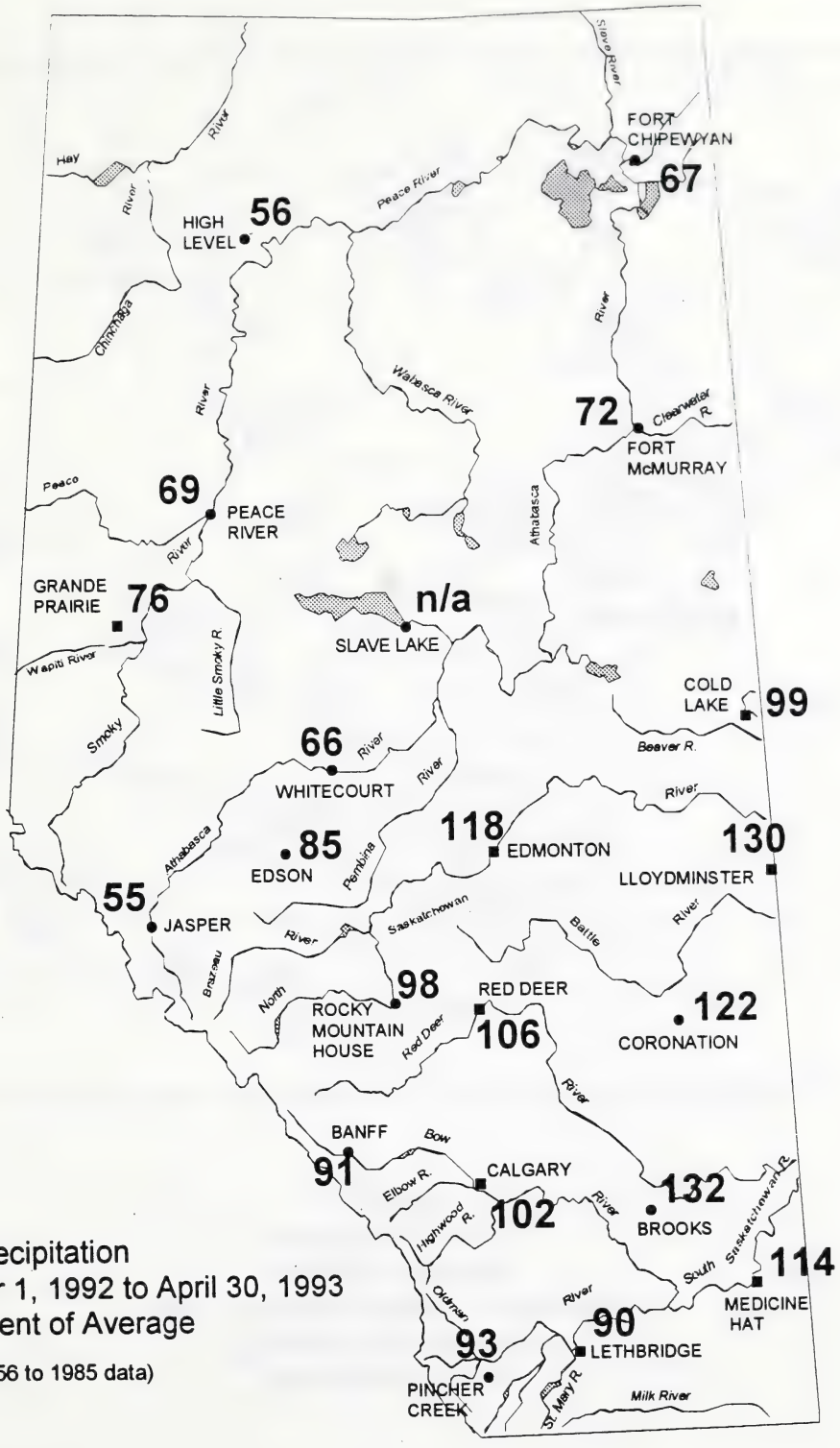


Figure 2
Winter Precipitation
November 1, 1992 to April 30, 1993
as a per cent of Average

(based on 1956 to 1985 data)

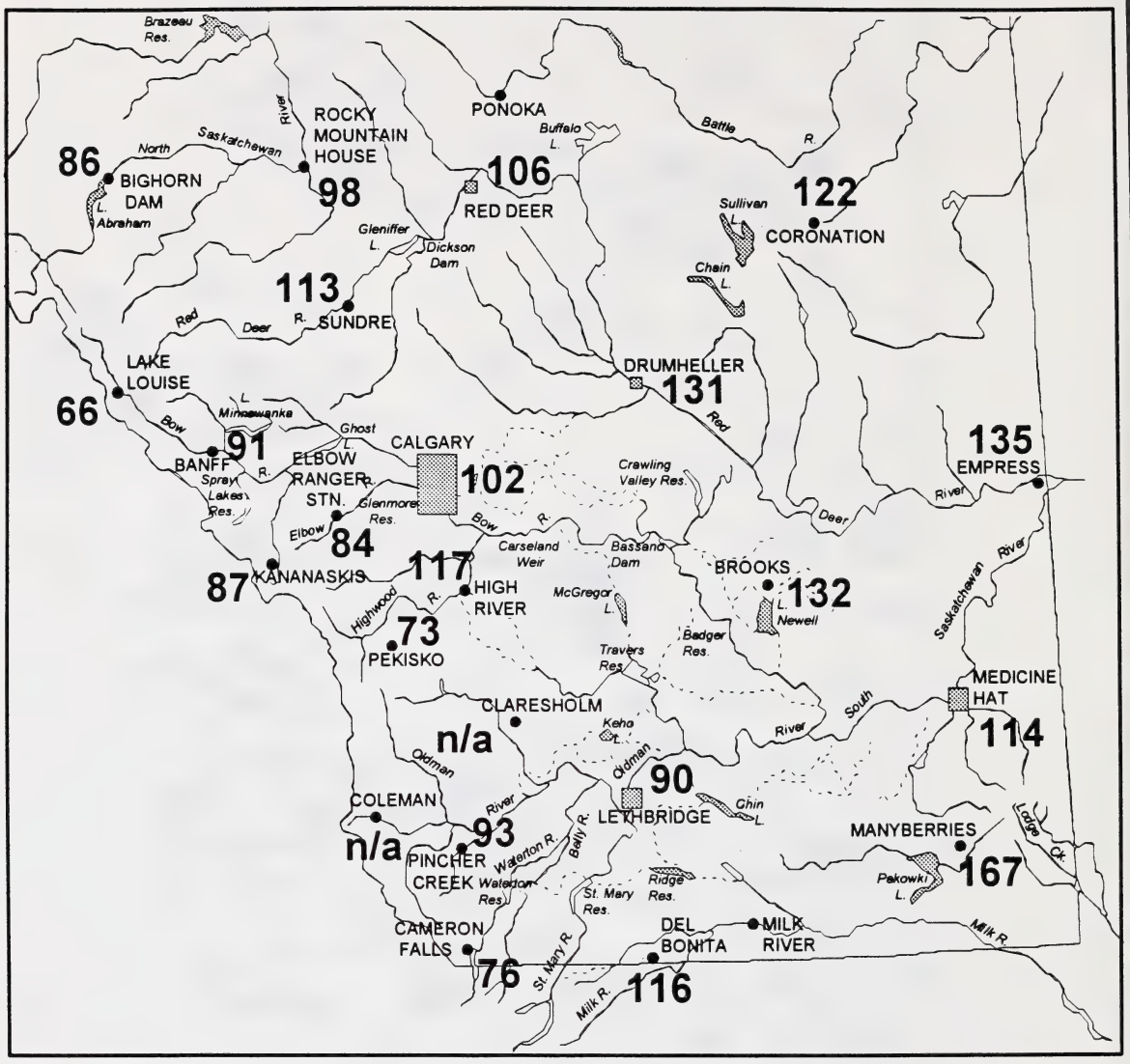


Figure 3
Winter Precipitation
Southern Alberta
November 1, 1992 to April 30, 1993
as a per cent of Average
(based on 1956 to 1985 data)

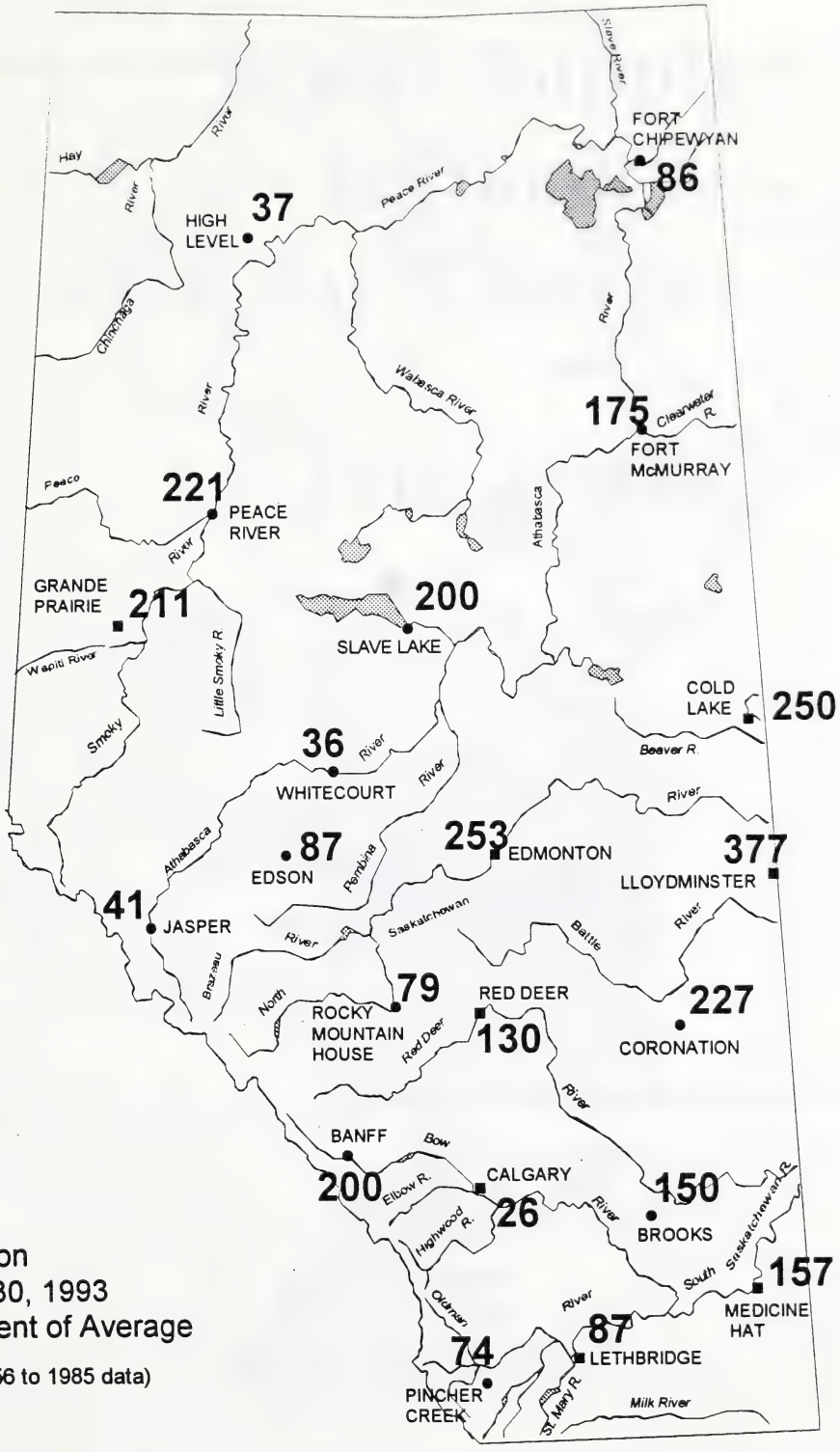


Figure 4
Precipitation
April 1 to 30, 1993
as a per cent of Average

(based on 1956 to 1985 data)

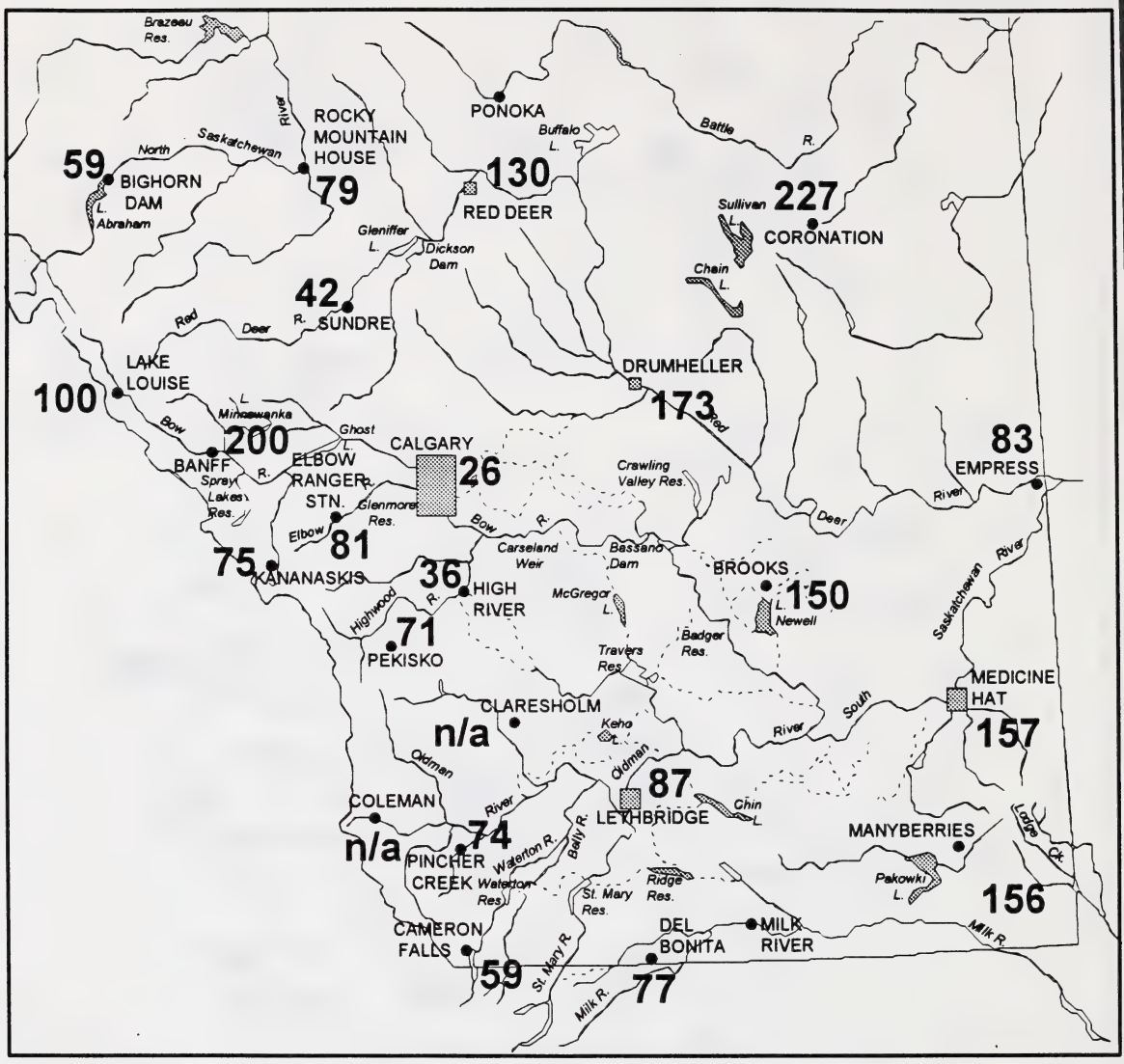
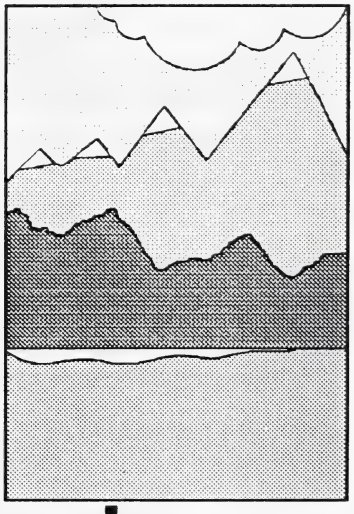


Figure 5
Precipitation
Southern Alberta
April 1 to 30, 1993
as a per cent of Average
(based on 1956 to 1985 data)

CANADIANA
JUN 29 1993

Water Supply Outlook for Alberta

June 1993



Alberta
ENVIRONMENTAL PROTECTION

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly, from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks. We also appreciate the assistance of a number of private citizens who diligently report observations of precipitation and other data.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

June 1993

Overview

The most major change in the water supply outlook is for the Oldman River basin. The volume forecast for the Oldman River basin for the rest of the season (June through September) is less than the volume estimated in the previous forecast in May. The streamflow volumes in May were higher than average in the Oldman River areas because mountain snowmelt was earlier than usual. Therefore, flows in the Oldman system are expected to be much lower than average for the balance of the season. The total water supply forecast for the headwaters of the Milk River basin has also decreased slightly. Streamflow volumes are still expected to be much-below-average for the Bow, North Saskatchewan and Athabasca Rivers for this summer. The water supply conditions forecast for the Red Deer River basin are expected to be better than previously forecast in the May water supply outlook.

Most of the mountain snowpack melted earlier than usual this year. Because mountain snowpack conditions were very low for this time of the year, it took less time to melt. As of June 1st, most high elevations areas had very little if any snowpack left. Mountain snow course were at or less than previously recorded minimums in the headwaters of all the rivers originating along the eastern slopes of the Rocky Mountains. Consequently river levels are receding sooner than usual this summer.

The water storage in most of the major hydroelectric reservoirs is normal. The water storage in most of the major irrigation reservoirs is normal to above-normal. More water than usual has been stored in these reservoirs because there has been less demand for irrigation this spring and mountain snowmelt was early this year. This is the first full operating season of the Oldman Dam and it was very close to the full supply level as of June 1, 1993. Water from mountain snowmelt has been stored in the Oldman Dam in anticipation of irrigation demands this summer. Precipitation between now and the end of September will affect the summer water supply.

At the end of the month, up to 70 millimetres of rain fell along the eastern slopes of the Rocky Mountains in the headwaters of the southern part of the Bow and in the northern part of Oldman River basin mountain headwaters in southwestern Alberta. The Highwood, Elbow, Sheep, north fork of the Oldman upstream of the Oldman Dam, Castle, Crowsnest, main stem of the Oldman River downstream of Lethbridge and mainstem of the Bow River downstream of Calgary rose quickly in response to the heavy rainfall. May precipitation was close to average for areas in southern and central Alberta. The southeast, east central and northwest areas of Alberta had much-below-average rainfall.

Groundwater levels have remained fairly constant over the past month. At present, groundwater levels for both shallow and deep wells are below-normal in most central, northeastern and northern areas of the province. Levels in shallow wells in southern areas are below-normal to normal.

Water Supply Volume Forecasts for the Summer of 1993

The most major change in the water supply outlook is for the Oldman River basin. The volume forecast for the Oldman River basin for the rest of the season (June through September) is less than the volume estimated in the previous forecast in May. The streamflow volumes in May were higher than average in the Oldman River areas because mountain snowmelt was earlier than usual. Therefore, flows in the Oldman system are expected to be much lower than average for the balance of the season. The total water supply forecast for the headwaters of the Milk River basin has also decreased slightly. Streamflow volumes are still expected to be much-below-average for the Bow, North Saskatchewan and Athabasca Rivers for this summer. The water supply conditions forecast for the Red Deer River basin are expected to be better than previously forecast in the May water supply outlook.

Because of the much-below-average snowpack at high elevations, peak mountain snow melt has occurred much earlier than normal for all streams with mountain headwaters. Consequently river levels are receding sooner than usual this summer.

Precipitation between now and the end of September will affect the summer water supply. The streamflow volume forecasts will be updated monthly until mid-summer. The volume forecasts are presented in the following table. The actual May 1993 streamflow volumes are also given. More detailed streamflow forecasts are presented in Tables 1,2,4,6 and 8.

Water Supply Volume Forecasts as of June 1, 1993

Location	June to September 1993 Natural Streamflow Volume Forecasts as a per cent of average	Actual Natural Streamflow Volumes May 1993 as a per cent of average
Milk River at Milk River	70	31*
Oldman River at Lethbridge	65	76
Bow River at Calgary	75	118
Red Deer River at Red Deer	90	73
North Saskatchewan River at Edmonton	75	98

* The value for Milk River is for the period April 1 to May 31, 1993.

Alberta
ENVIRONMENTAL PROTECTION

Water Storage Situation

The water storage in most of the major hydroelectric reservoirs is normal (Tables 3,5,7 and 9). Lake Abraham and Lower Kananaskis Lake are above-normal.

The water storage in most of the major irrigation reservoirs is normal to above-normal. The St. Mary, Ridge, Waterton, Lake Newell and Lake McGregor Reservoirs are above-normal. More water than usual has been stored in these reservoirs because there was less demand for irrigation this spring and the mountain snowmelt was early this year.

Currently, the total water storage in the Oldman River basin is more than double (720, 000 dam3 more) the storage at this time last year. This is the first full operating season of the Oldman Dam and it was very close to the full supply level as of June 1, 1993. Water from mountain snowmelt has also been stored in the Oldman Dam in anticipation of irrigation demands this summer.

Milk River Basin

Table 1 Water Supply Outlook as of June 1, 1993 - Milk River Basin (Natural Flows)

Locations	Volume Forecast for June 1 to September 30					Apr to May 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Milk River at Milk River	26,000	21,000	70	45 - 100	30	31

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given;; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Oldman River Basin

Table 2 Water Supply Outlook as of June 1, 1993 - Oldman River Basin

Locations	Volume Forecast for June 1 to September 30					May 1993 Natural Flow as a % of Average
	Volume in Dam3	Volume in Acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
St. Mary River	370,000	300,000	70	60 - 90	55	86
Belly River	120,000	97,300	65	55 - 85	45	79
Waterton River	290,000	235,000	65	55 - 85	45	87
Oldman River Dam Inflow	470,000	381,000	65	55 - 85	40	67
Oldman River near Lethbridge	1,340,000	1,090,000	65	55 - 75	40	76

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 3 Status of Major Water Storage Reservoirs as of June 1, 1993
Oldman River Basin

Reservoirs	Current Live Storage			Remarks	June 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as % of Maximum		dam3	acre-feet
Keho Lake	87,000	70,500	91	normal	88,000	71,000
Waterton Reservoir	98,200	79,600	86	above-normal	27,000	21,900
St. Mary Reservoir	353,000	286,000	96	above-normal	181,000	147,000
Ridge Reservoir	111,000	90,000	86	above-normal	96,000	78,000
Total	562,000	456,000	92	above-normal	304,000	247,000
Chin Reservoir	163,000	132,000	86	normal	181,000	147,000
Forty Mile Reservoir	85,100	69,000	99	normal	83,000	67,000
Total	248,000	201,000	90	normal	264,000	214,000
Oldman Reservoir	483,000	392,000	98	n/a	60,900	49,400

Bow River Basin

Table 4 Water Supply Outlook as of June 1, 1993 - Bow River Basin

Locations	Volume Forecast for June 1 to September 30					May 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Bow River at Banff	730,000	592,000	80	75 - 90	70	134
Bow River at Calgary	1,530,000	1,240,000	75	70 - 85	65	118
Elbow River	110,000	89,200	80	70 - 90	60	89
Highwood River	260,000	210,000	70	60 - 90	50	87
Lake Minnewanka Inflow	126,000	102,000	70	60 - 80	55	104
Spray Lake Inflow	200,000	162,000	75	65 - 80	60	127
Kananaskis River	240,000	195,000	75	65 - 90	55	54

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 5 Status of Major Water Storage Reservoirs as of June 1, 1993 - Bow River Basin

Reservoirs	Current Live Storage			Remarks	June 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Minnewanka	103,000	83,500	46	normal	77,000	62,400
Spray Lake	50,500	40,900	28	n/a*	26,000	21,100
Upper Kananaskis Lake	30,000	24,300	29	above-normal	17,900	14,500
Lower Kananaskis Lake	20,100	16,300	32	normal	10,300	8,400
Total	204,000	165,000	36	normal	131,000	106,000
Lake McGregor	299,000	242,000	93	above-normal	262,000	212,000
Travers Reservoir	101,000	81,900	97	normal	115,000	93,000
Total	400,000	324,000	94	above-normal	377,000	305,000
Lake Newell	174,000	141,000	98	above-normal	135,000	109,000
Crawling Valley Reservoir	110,000	89,100	98	normal	88,000	71,000
Total	284,000	230,000	98	above-normal	223,000	180,000

*The full supply level (FSL) for Spray Lake has increased from 1694.7 to 1697.7m, Jan. 1993.

Red Deer River Basin

Table 6 Water Supply Outlook as of June 1, 1993 - Red Deer River Basin

Locations	Volume Forecast for June 1 to September 30					May 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Glennifer Lake	700,000	567,000	85	70 - 100	60	87
Red Deer River at Red Deer	610,000	495,000	90	75 - 105	60	73

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 7 Status of Major Water Storage Reservoirs as of June 1, 1993 - Red Deer River Basin

Reservoirs	Current Live Storage			Remarks	June 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Glennifer Lake	149,000	121,000	73	normal	126,000	102,000

North Saskatchewan River Basin

Table 8 Water Supply Outlook as of June 1, 1993 - North Saskatchewan River Basin

Locations	Volume Forecast for June 1 to September 30					May 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Lake Abraham Inflow	1,580,000	1,280,000	80	75 - 90	70	194
Brazeau Reservoir Inflow	850,000	689,000	75	60- 90	50	93
North Saskatchewan River at Edmonton	3,500,000	2,840,000	75	65 - 90	60	98

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 9 Status of Major Water Storage Reservoirs as of June 1, 1993 - North Saskatchewan River Basin

Reservoirs	Current Live Storage			Remarks	June 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Abraham	249,000	202,000	18	above-normal	68,800	55,800
Brazeau Reservoir	113,000	91,600	23	normal	97,700	79,200
Total	362,000	294,000	19	normal	166,000	135,000

Groundwater Conditions

Groundwater levels have remained fairly constant over the past month. At present, groundwater levels for both shallow (less than 20 metres) and deep (greater than 20 metres) wells are below-normal in most central, northeastern and northern areas of the province. Levels in shallow wells in southern areas are below-normal to normal. Shallow wells in the Devon and Del Bonita - Milk River areas have declined considerably, although they are still at normal levels for the season. Deep well levels in the south ranged from below-normal to above-normal. Deep wells in the Milk River and Calgary areas are below-normal. The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of June 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	below-normal
Cypress Hills	below-normal	above-normal
Lethbridge	normal	above-normal
Calgary	below-normal	below-normal
Coronation-Brooks	below-normal	below-normal
Red Deer	below-normal	below-normal
Edson	normal	normal
Edmonton-Lloydminster	normal	below-normal
Whitecourt-Athabasca	normal	below-normal
Cold Lake	below-normal	normal
Grande Prairie-Peace River	normal	normal

Mountain Snowpack

Most of the mountain snowpack melted earlier than usual this year. Temperatures were average to above-average for most of May in the mountain parks and most central and northern areas. Because mountain snowpack conditions were very low for this time of the year, it took less time to melt. As of June 1st, most high elevations areas had very little if any snowpack left. Mountain snow courses were at or less than previously recorded minimums in the headwaters of all of the rivers originating along the eastern slopes of the Rocky Mountains. This includes the Oldman, Highwood, Kananaskis, Bow, Red Deer, North Saskatchewan and Athabasca River basins (Figure 1).

Mountain Snowpack (continued)

Mountain snowpack conditions were less than 50 per cent of average in the headwaters of the Oldman and in the southern part of the Bow river basin for this time of the year. In the headwaters of the northern part of the Bow and in the North Saskatchewan River basin, mountain snowpack was less than 40 per cent of average as of June 1, 1993. Mountain snowpack for the Athabasca River headwaters was less than 30 percent of average. Very little mountain snowpack was reported in the Red Deer River headwaters.

May 1993 Weather and Streamflow Conditions

At the beginning of May, up to 75 millimetres of precipitation caused streamflows in the Sawridge Creek and Chinchaga, Driftpile, East and West Prairie and Wabasca Rivers rose sharply from below-normal flows up to a normal level for the season. Prior to this storm, streams in northern Alberta were below-normal because of below-normal spring runoff.

Streams with mountain headwaters rose sharply in response the mountain snowmelt mid-month. The mountain headwaters of the Oldman and Red Deer River basin peaked about mid-month. Most streams with mountain headwaters were near their peak flow from mountain snowmelt about three weeks earlier than usual.

A high streamflow advisory was issued on June 1, 1993 for the Highwood, Elbow, Sheep, north fork of the Oldman upstream of the Oldman Dam, Castle and Crowsnest Rivers. These streams rose quickly in response to up to 70 millimetres of rain along the eastern slopes of the Rocky Mountains, which fell May 31 to June 2 (Figure 4). A high streamflow advisory was also issued on June 2, 1993 for the mainstem of the Bow River downstream of Calgary and the mainstem of the Oldman River downstream of Lethbridge. The downstream reaches of the Bow and Oldman Rivers rose about one metre in response to the heavy rainfall. By June 5, 1993, flows for the South Saskatchewan at Medicine Hat had risen from below-average levels to only slightly above-average levels for the season and were receding slowly.

May Precipitation

May precipitation was close to average for areas in southern and central Alberta. The southeast, east central and northwest areas of Alberta had much-below-average rainfall for May. Southeastern Alberta in particular had much-below-average precipitation during May. Showers in the areas east of Medicine Hat, near the Saskatchewan border, produced close to average May precipitation. Precipitation was much-abov- average in the Jasper area. In the Calgary, Kananaskis, Slave Lake and Bighorn Dam areas, precipitation was above-average (Figure 2).

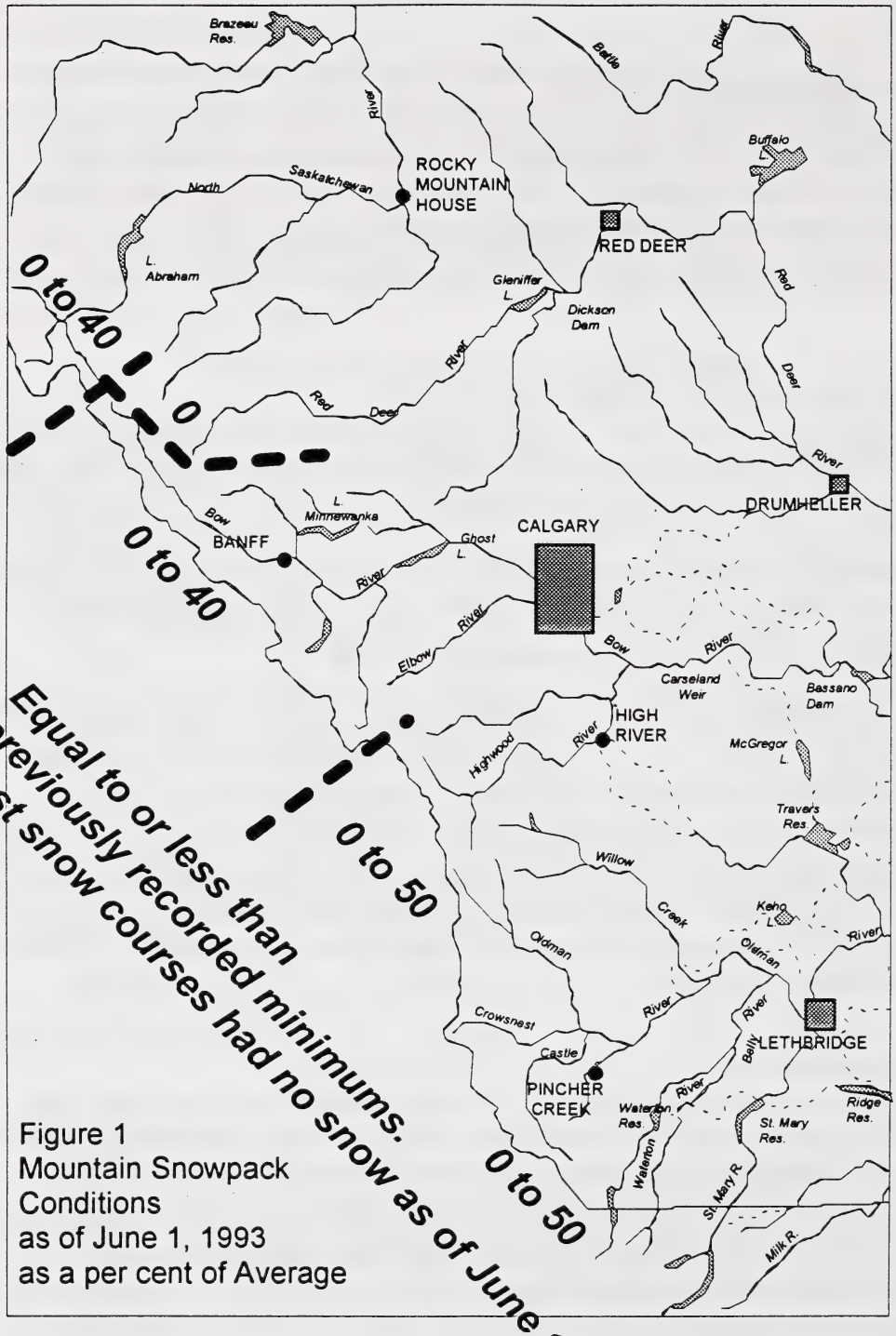


Figure 1
Mountain Snowpack Conditions
as of June 1, 1993
as a per cent of Average

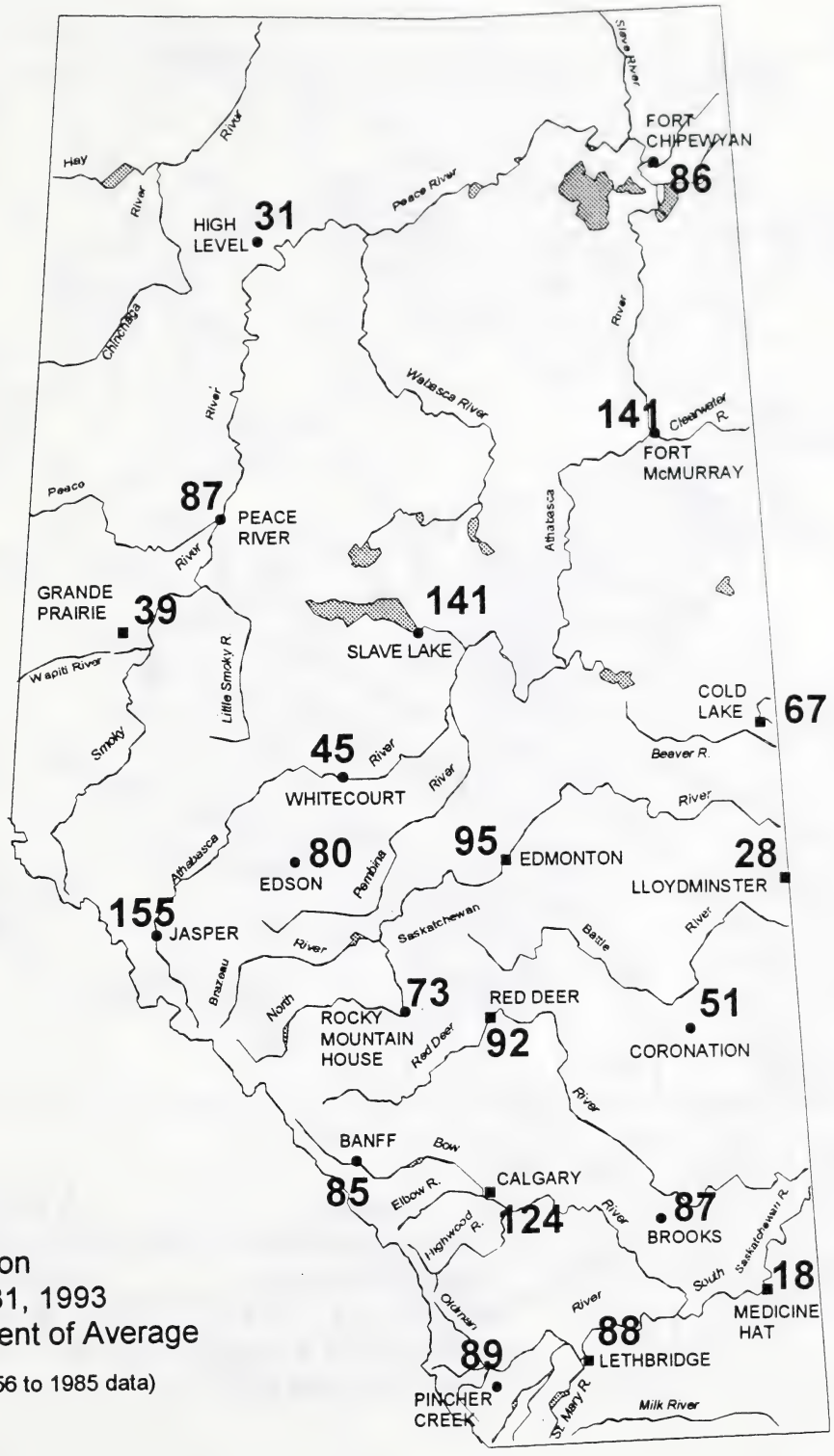


Figure 2
Precipitation
May 1 to 31, 1993
as a per cent of Average

(based on 1956 to 1985 data)

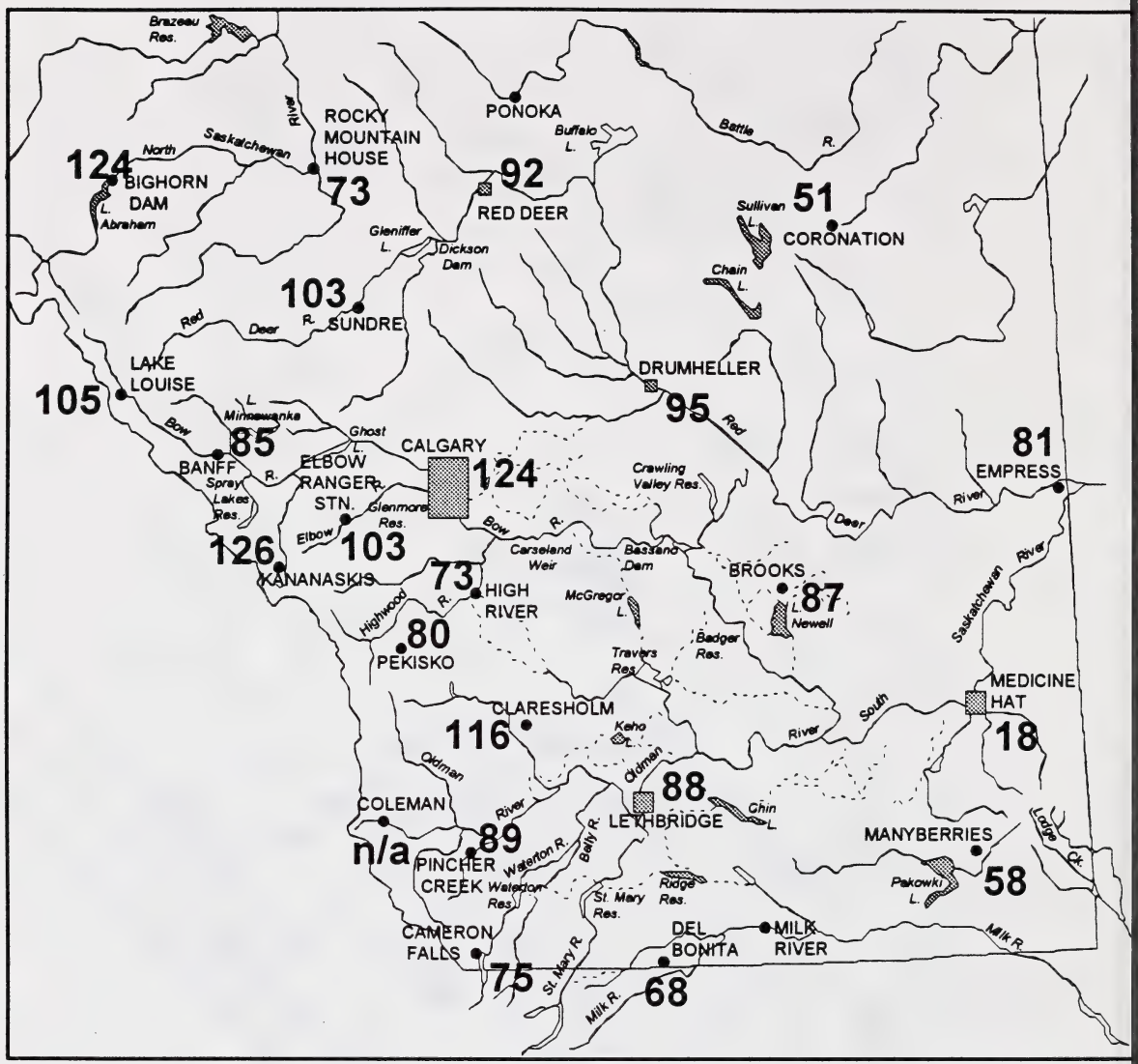


Figure 3
Precipitation
Southern Alberta
May 1 to 31, 1993
as a per cent of Average
(based on 1956 to 1985 data)

Alberta
ENVIRONMENTAL PROTECTION

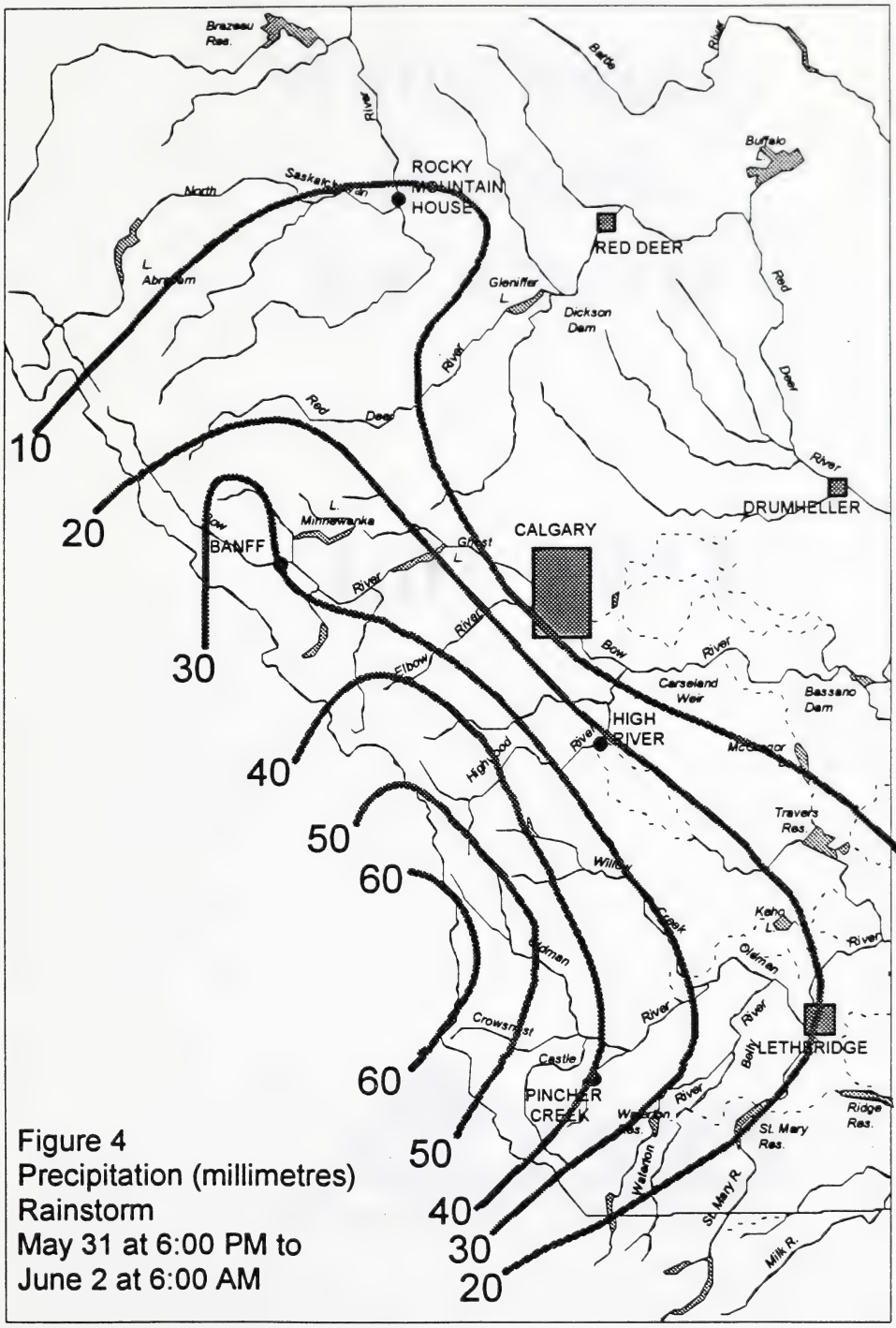


Figure 4
Precipitation (millimetres)
Rainstorm
May 31 at 6:00 PM to
June 2 at 6:00 AM

CANADIANA

JUL 21 1993

Water Supply Outlook for Alberta

July 1993

Notes

Alberta Environmental Protection publishes the **"Water Supply Outlook for Alberta"** monthly, from February to August. These reports are prepared by the River Forecast Centre, the Hydrogeology Branch, and the Survey Branch of the Department's Technical Services and Monitoring Division.

Alberta Environmental Protection is grateful for the assistance of Environment Canada (the Atmospheric Environment Service and Water Resources Branch) in providing weather, precipitation and streamflow data. Snow survey data are also provided by the U.S. Soil Conservation Service of Montana and the British Columbia Ministry of Environment, Lands and Parks. We also appreciate the assistance of a number of private citizens who diligently report observations of precipitation and other data.

All data summarized in this publication are preliminary and subject to revision. Data are available on request.

Equivalents of Measure

Parameter	Metric Unit	Conversion to Imperial Units
Snow depth	centimetres	2.54 cm = 1 inch
Water Equivalent	millimetres	25.4 mm = 1 inch
Elevation	metres	1 m = 3.2808 feet
Streamflow	cubic metres per second	1 cms = 35.3 cfs
Volume	cubic decametre (dam^3)	1 dam^3 = 1000 m^3 = 0.8107 acre-feet

Water Supply Outlook for Alberta

July 1993

Overview

Water supply conditions have significantly improved for the headwaters of the Oldman, Highwood, Elbow and Red Deer River basins. Streamflow volume forecasts have improved in these areas because June precipitation was much-above-average all along the mountains and foothills. Therefore, flows in these river basins are expected to be average to above-average for the remainder of the season. However, below-average runoff for the rest of the summer is still forecast in the Milk, St. Mary, Belly, Waterton and northern part of the Bow River basins. Streamflow volumes are still expected to be much-below-average for the North Saskatchewan and Athabasca Rivers for this summer. Precipitation between now and the end of September will affect the summer water supply.

The water storage in most of the major hydroelectric reservoirs is normal. Upper Kananaskis Lake is above-normal. The water storage in most of the major irrigation reservoirs is normal to above-normal. The St. Mary, Ridge, Waterton, Lake Newell and Lake McGregor Reservoirs are above-normal. Although runoff has been below normal in the Oldman and Bow River basins during May and June 1993, more water than usual is currently in storage because of less irrigation demand. The water storage in the Oldman Reservoir remains close to the full supply level as of July 1, 1993.

Groundwater levels improved for most areas of the province during June. Shallow wells in the Cold Lake area remained below-average for the season and deep wells in this area are normal. Levels in shallow wells are below-normal in south-central areas, normal in north-central areas and normal in northern areas. Deep well levels are normal to above-normal in the south, below-normal to normal in central Alberta and normal in northern areas.

Significant rainfall in June brought flows in most of the province up from below-average levels to average for the season.

Precipitation in May and June was average to above-average for most areas of the province; although a major portion of the precipitation came in the latter part of June. The northwest part of the province (High Level area) has had much-below-average precipitation so far this summer. The total precipitation for May and June was much-above-average all along the foothills and mountains, from the Montana border up to the headwaters of the Peace River west of Peace River. In east-central areas, including Coronation and Empress, summer precipitation has been much-above-average. In central Alberta, summer precipitation was average.

June precipitation was above-average for most areas of Alberta. In particular, the foothills areas west of Claresholm and the Medicine Hat area and the Grande Prairie - Ft. John area had much-above-average precipitation in June.

Water Supply Volume Forecasts for the Summer of 1993

Water supply conditions have significantly improved for the headwaters of the Oldman, Highwood, Elbow and Red Deer River basins. Streamflow volume forecasts have improved in these areas because June precipitation was much-above-average all along the mountains and foothills. Therefore, flows in these river basins are expected to be average to above-average for the remainder of the season. However, below-average runoff for the rest of the summer is still forecast in the Milk, St. Mary, Belly, Waterton and northern part of the Bow River basins. Streamflow volumes are still expected to be much-below-average for the North Saskatchewan and Athabasca Rivers for this summer.

Precipitation between now and the end of September will affect the summer water supply. The volume forecasts are presented in the following table. The actual May - June 1993 streamflow volumes are also given. More detailed streamflow forecasts are presented in Tables 1,2,4,6 and 8.

Water Supply Volume Forecasts as of July 1, 1993

Location	July to September 1993 Natural Streamflow Volume Forecasts as a per cent of average	Actual Natural Streamflow Volumes May to June 1993 as a per cent of average
Milk River at Milk River	35	33*
Oldman River at Lethbridge	90	75
Bow River at Calgary	80	83
Red Deer River at Red Deer	90	72
North Saskatchewan River at Edmonton	70	74

* The value for Milk River is for the period April 1 to June 30, 1993.

Water Storage Situation

The water storage in most of the major hydroelectric reservoirs is normal (Tables 3,5,7 and 9). Upper Kananaskis Lake is above-normal.

The water storage in most of the major irrigation reservoirs is normal to above-normal. The St. Mary, Ridge, Waterton, Lake Newell and Lake McGregor Reservoirs are above-normal. Although runoff has been below normal in the Oldman and Bow River basins during May and June 1993, more water than usual is currently in storage because of less irrigation demand.

The water storage in the Oldman Reservoir remains close to the full supply level as of July 1, 1993.

Milk River Basin

Table 1 Water Supply Outlook as of July 1, 1993 - Milk River Basin (Natural Flows)

Locations	Volume Forecast for July 1 to September 30					Apr to June 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Milk River at Milk River	5,500	4,500	35	20 - 80	10	33

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given;; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Oldman River Basin

Table 2 Water Supply Outlook as of July 1, 1993 - Oldman River Basin

Locations	Volume Forecast for July 1 to September 30					May to June 1993 Natural Flow as a % of Average
	Volume in Dam3	Volume in Acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
St. Mary River	200,000	160,000	80	70 - 100	60	67
Belly River	73,000	59,000	80	65 - 100	60	63
Waterton River	130,000	100,000	75	60 - 100	55	69
Oldman River Dam Inflow	290,000	240,000	100	70 - 120	60	74
Oldman River near Lethbridge	830,000	670,000	90	65 - 110	60	75

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 3 Status of Major Water Storage Reservoirs as of July 1, 1993
Oldman River Basin

Reservoirs	Current Live Storage			Remarks	July 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as % of Maximum		dam3	acre-feet
Keho Lake	85,300	69,200	89	above-normal	89,000	72,300
Waterton Reservoir	98,300	79,700	86	above-normal	104,000	84,100
St. Mary Reservoir	356,000	289,000	96	above-normal	362,000	293,000
Ridge Reservoir	111,000	90,000	86	above-normal	119,000	96,500
Total	565,000	459,000	92	above-normal	585,000	474,000
Chin Reservoir	152,000	123,000	80	normal	161,000	131,000
Forty Mile Reservoir	85,700	69,300	99	normal	86,200	70,000
Total	238,000	192,000	86	normal	247,000	201,000
Oldman Reservoir	474,000	384,000	96	n/a	125,000	101,000

Bow River Basin

Table 4 Water Supply Outlook as of July 1, 1993 - Bow River Basin

Locations	Volume Forecast for July 1 to September 30					May to June 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Bow River at Banff	450,000	360,000	80	75 - 90	65	81
Bow River at Calgary	1,010,000	820,000	80	70 - 90	55	83
Elbow River	85,000	69,000	110	80 - 130	70	115
Highwood River	190,000	150,000	115	80 - 130	70	114
Lake Minnewanka Inflow	80,000	53,000	75	65 - 90	50	77
Spray Lake Inflow	125,000	100,000	80	65 - 80	55	86
Kananaskis River	140,000	110,000	70	65 - 90	50	45

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 5 Status of Major Water Storage Reservoirs as of July 1, 1993 - Bow River Basin

Reservoirs	Current Live Storage			Remarks	July 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Minnewanka	140,000	113,000	63	normal	127,000	103,000
Spray Lake	106,000	85,900	60	below-normal	77,400	62,700
Upper Kananaskis Lake	54,100	43,900	53	above-normal	48,600	39,400
Lower Kananaskis Lake	38,100	30,900	60	normal	32,000	26,000
Total	338,000	274,000	60	normal	285,000	231,000
Lake McGregor	285,000	231,000	89	above-normal	278,000	225,000
Travers Reservoir	94,200	76,400	90	normal	115,000	93,200
Total	379,000	307,000	89	above-normal	393,000	318,000
Lake Newell	174,000	141,000	98	above-normal	166,000	135,000
Crawling Valley Reservoir	110,000	89,200	98	normal	104,000	84,300
Total	284,000	230,000	98	above-normal	270,000	219,000

*The full supply level (FSL) for Spray Lake has increased from 1694.7 to 1697.7m, Jan. 1993.

Red Deer River Basin

Table 6 Water Supply Outlook as of July 1, 1993 - Red Deer River Basin

Locations	Volume Forecast for July 1 to September 30					May to June 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as % of Average	
Glennifer Lake	350,000	280,000	85	70 - 100	60	83
Red Deer River at Red Deer	460,000	370,000	90	70 - 110	60	72

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 7 Status of Major Water Storage Reservoirs as of July 1, 1993 - Red Deer River Basin

Reservoirs	Current Live Storage			Remarks	July 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Glennifer Lake	163,000	132,000	80	normal	166,000	135,000

North Saskatchewan River Basin

Table 8 Water Supply Outlook as of July 1, 1993 - North Saskatchewan River Basin

Locations	Volume Forecast for July 1 to September 30					May to June 1993 Natural Flow as a % of Average
	Volume in dam3	Volume in acre-feet	Volume as a % of Average	Probable Range as a % of Average	Reasonable Minimum as a % of Average	
Lake Abraham Inflow	1,150,000	930,000	80	70 - 90	65	105
Brazeau Reservoir Inflow	510,000	410,000	70	60- 90	50	76
North Saskatchewan River at Edmonton	2,150,000	1,700,000	70	55 - 90	50	74

NOTE: There is: a 50% chance that the actual natural flow will fall within the probable range given; a 25% chance that the actual flow will be less than the lower bound of the probable range given; and a 10% chance that the actual natural flow will be less than the reasonable minimum. Forecasts indicate natural runoff expected for the season. Actual day to day streamflow conditions may vary throughout the season as a result of the effects of streamflow diversion and reservoir storage. Volume forecasts are based on snow surveys, winter precipitation and assumptions about precipitation for the remainder of the season.

Table 9 Status of Major Water Storage Reservoirs as of July 1, 1993 - North Saskatchewan River Basin

Reservoirs	Current Live Storage			Remarks	July 1, 1992 Live Storage	
	Volume in dam3	Volume in acre-feet	Volume as a % of Maximum		dam3	acre-feet
Lake Abraham	427,000	346,000	30	normal	411,000	333,000
Brazeau Reservoir	236,000	191,000	49	normal	224,000	182,000
Total	663,000	537,000	35	normal	635,000	515,000

Groundwater Conditions

Groundwater levels improved for most areas of the province during June. Shallow wells in the Cold Lake area remained below-average for the season and deep wells in this area are normal. Levels in shallow wells are below-normal in south-central areas, normal in north-central areas and normal in northern areas. Deep well levels are normal to above-normal in the south, below-normal to normal in central Alberta and normal in northern areas. The information in the following table describes wells that are primarily influenced by climatic conditions.

Groundwater Conditions as of July 1, 1993

Area	Shallow Wells	Deep Wells
Milk River	normal	normal
Cypress Hills	normal	above-normal
Lethbridge	normal	above-normal
Calgary	below-normal	normal
Coronation-Brooks	below-normal	below-normal
Red Deer	below-normal	below-normal
Edson	normal	normal
Edmonton-Lloydminster	normal	below-normal
Whitecourt-Athabasca	normal	below-normal
Cold Lake	below-normal	normal
Grande Prairie-Peace River	normal	normal

June 1993 Weather and Streamflow Conditions

There were four major rainstorms in June that brought flows in most of the province up from below-average levels to average for the season. At the beginning of the month, flows in the Highwood, Elbow, Sheep, Oldman River upstream of the Oldman Dam, Castle and Crowsnest Rivers were receding after a heavy rainstorm at the end of May. This precipitation brought flows in the South Saskatchewan River basin system from below-average levels up to only slightly above-average levels for the season.

June 1993 Weather and Streamflow Conditions (continued)

Following a second major rainstorm at mid-month, a high streamflow advisory was issued on June 12, 1993 for the Highwood River, Sheep River, Elbow River, Jumpingpound Creek (near Calgary), Ghost River (near Cochrane),Willow Creek, Upper Oldman River, Pincher Creek, Drywood Creek (near Pincher Creek), and Lee Creek (near Cardston). These streams rose quickly in response to 50 to 90 millimetres of rain along the eastern slopes of the Rocky Mountains, which fell June 12 to June 14. Much of the precipitation, in the mountain headwaters of the South Saskatchewan River basin, fell as snow at high elevations. A high streamflow advisory was issued on June 13, 1993 for the mainstem of the Bow River Bow River at the mouth, downstream of Bassano Dam and the mainstem of the Oldman River downstream of Lethbridge. Levels rose about one metre in response to the heavy rainfall.

With the arrival of a third storm, another high streamflow advisory was issued on June 16, 1993 for streams in southwestern Alberta following heavy rainfall west of Calgary and Lethbridge. This advisory included the Elbow River, Jumpingpound Creek, Sheep River, Highwood River, Willow Creek, Upper Oldman River, Pincher Creek, Drywood Creek, Lee Creek, Blakiston Creek and Cameron Creeks and the Oldman River upstream of Lethbridge and the Bow River downstream of Calgary.

On June 23, 1993, a flood warning was issued for streams and their tributaries in the Lesser Slave Lake area in north-central Alberta, including: the Swan River near Kinuso, Driftpile River, the East Prairie River, West Prairie River and Willow River near Wabasca. A flood warning was also issued for streams and their tributaries in northwestern Alberta including the Buffalo Head Hills area south of Fort Vermilion and the Wabasca River basin.

Summer 1993 Precipitation

Precipitation in May and June was average to above-average for most areas of the province (Figures 1 and 2); although a major portion of the precipitation came in the latter part of June. The northwest part of the province (High Level area) has had much-below-average precipitation so far this summer. The total precipitation for May and June was much-above-average all along the foothills and mountains, from the Montana border up to the headwaters of the Peace River west of Peace River. In central Alberta, summer precipitation was average. In east-central areas, including Coronation and Empress, summer precipitation has been much-above-average. The Grande Prairie, Peace River and Ft. McMurray areas have had above-average summer precipitation.

June Precipitation

June precipitation was above-average for most areas of Alberta. In particular, the foothills areas west of Claresholm and the Medicine Hat area had much-above-average rainfall of up to 250 millimetres this month. The Grande Prairie - Ft. John area had up to 220 millimetres of precipitation during June. Precipitation was close to average in the Edmonton, Whitecourt, Slave Lake and Ft. McMurray areas for June, with most of the rainfall occurring in the later part of the month. (Figures 3 and 4).

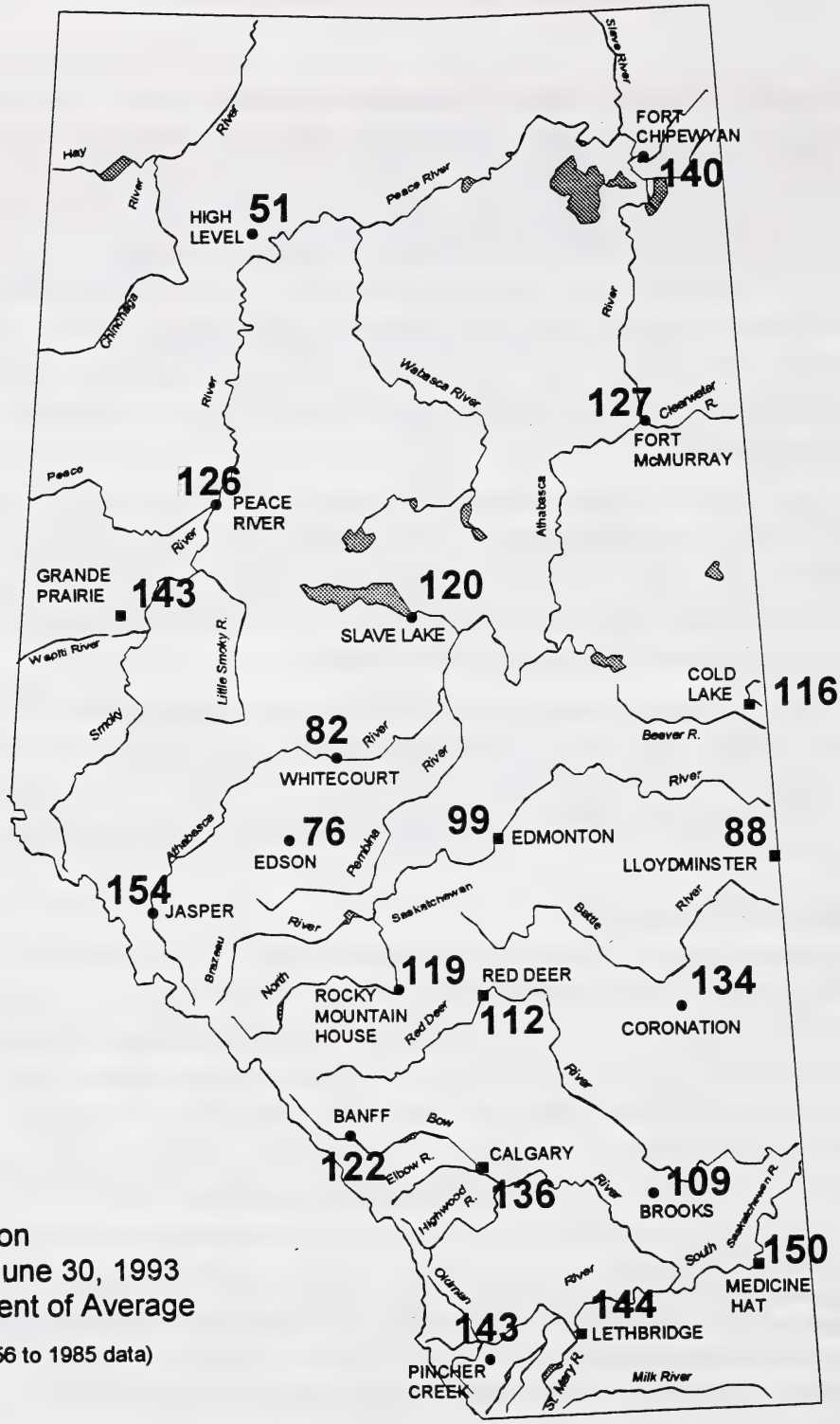


Figure 1
Precipitation
May 1 to June 30, 1993
as a per cent of Average

(based on 1956 to 1985 data)

Alberta
ENVIRONMENTAL PROTECTION

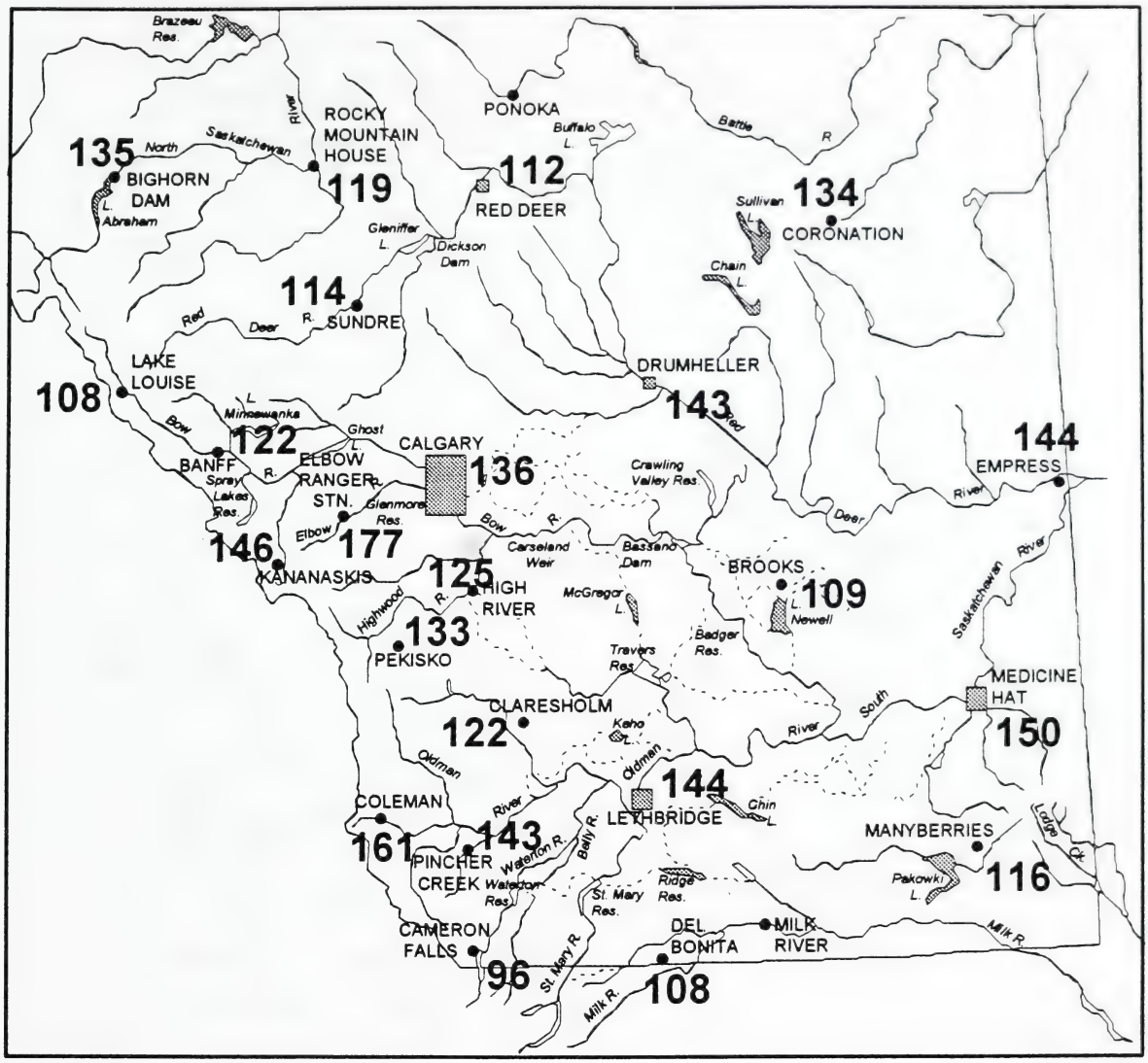


Figure 2
Precipitation
Southern Alberta
May 1 to June 30, 1993
as a per cent of Average
(based on 1956 to 1985 data)

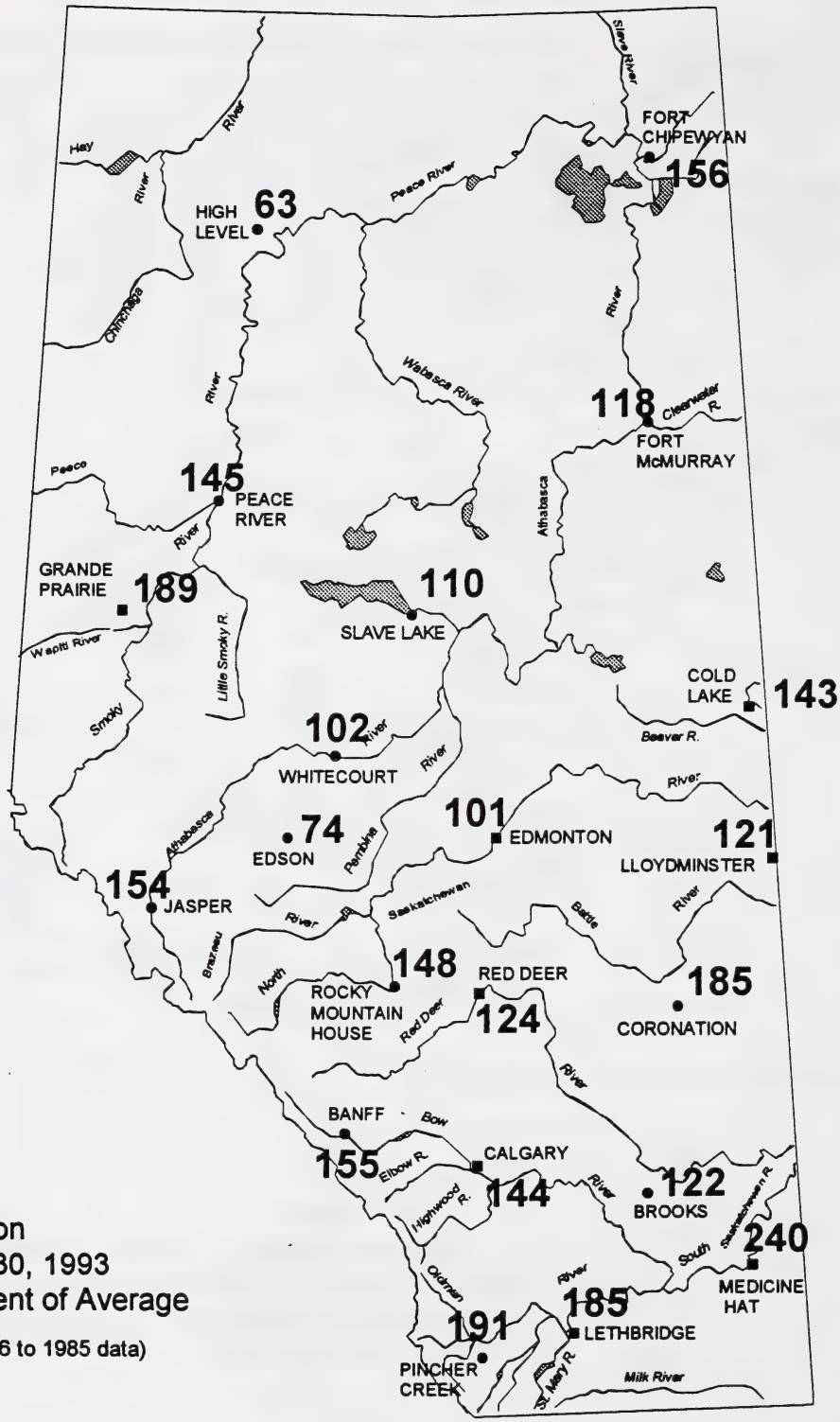


Figure 3
Precipitation
June 1 to 30, 1993
as a per cent of Average

(based on 1956 to 1985 data)

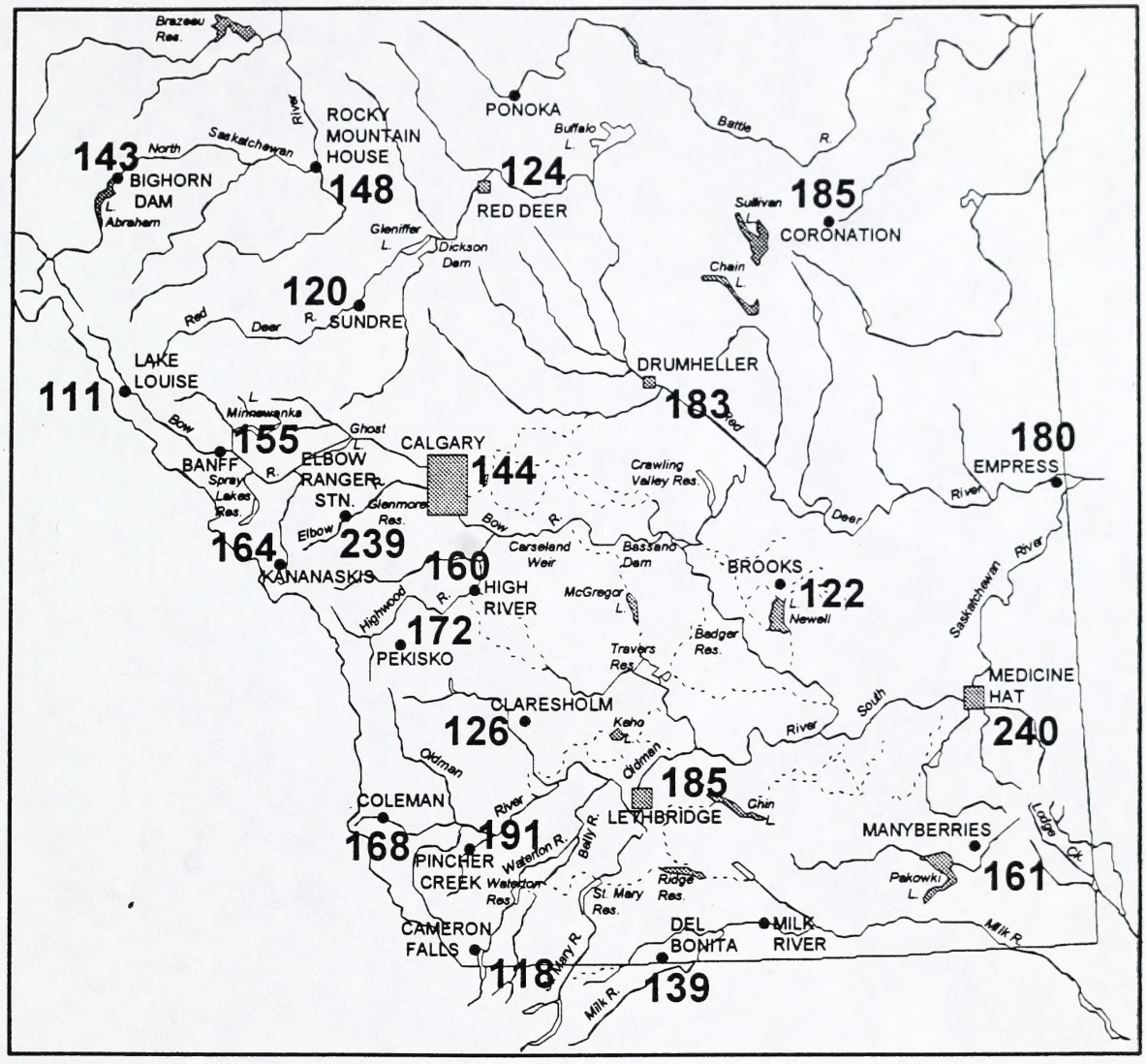


Figure 4
Precipitation
Southern Alberta
June 1 to 30, 1993
as a per cent of Average
(based on 1956 to 1985 data)

CALGARY
CORONATION